AUTOMOTIVE INDUSTRIES
The Automobile

Reg. U. S. Pat. Off.

Volume 66 Number 19

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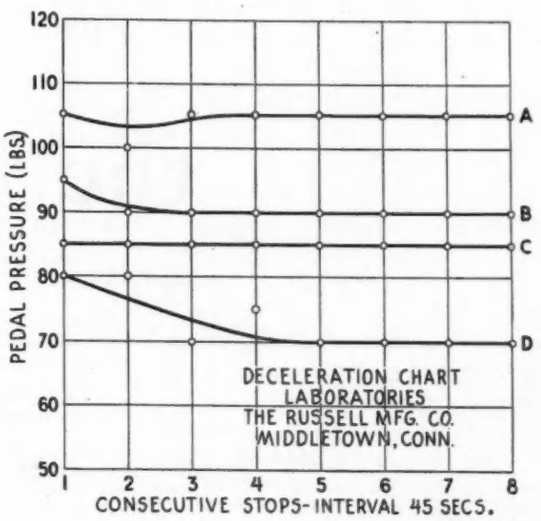
BANISHING
the Bogy of
FADE-OUT

No factor in brake performance has been given more consideration by Rusco Engineers than that of the elimination of fade-out. The remarkable success they have achieved in solving this problem is clearly illustrated by the accompanying chart.



The curves A, B, C and D show the action of typical Rusco Linings for 8 consecutive stops with four types of brakes—with the car operated at 45 miles an hour and stopped at a deceleration rate of 15 ft. per sec.² at intervals of 45 seconds.

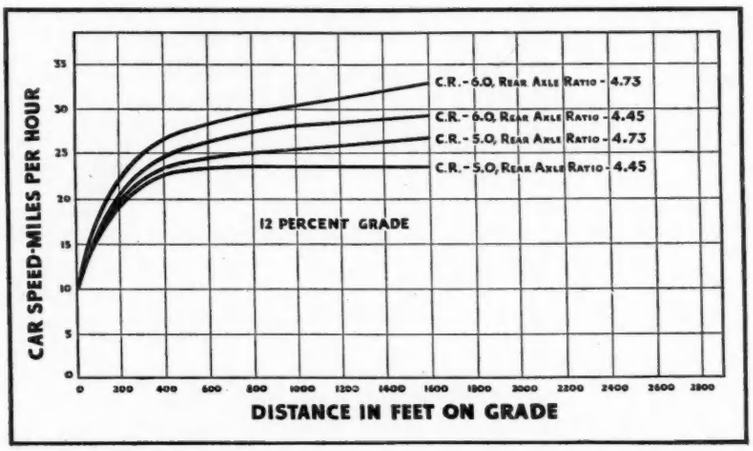
It is noteworthy that in none of the tests was more pedal pressure required for succeeding stops than for the first stop, indicating a complete absence of fade-out.

Also, the fact that the pedal pressure was different for each type of brake illustrates the ability of Rusco Engineers to produce a lining that meets any desired pedal pressure specifications.

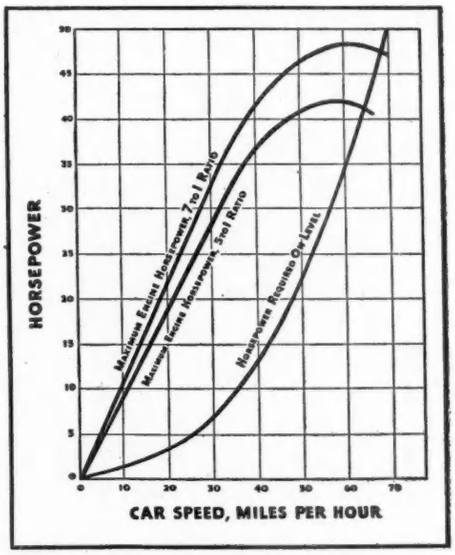
Complete charts showing performance data on Rusco Brake Linings for your brake will be furnished gladly upon request. Address Engineering Department C-4, The Russell Manufacturing Company, Middletown, Conn.

RUSCO
WOVEN, MOLDED or MOLDED-WOVEN
BRAKE LININGS

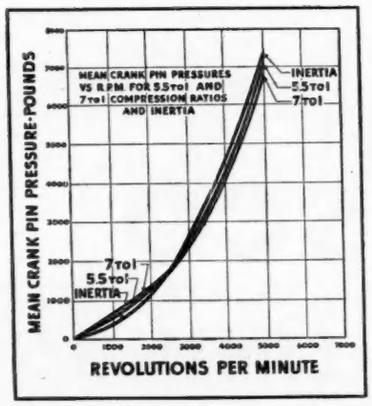
Who will BUILD the first *Super-*

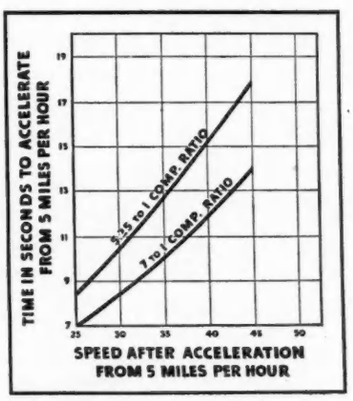

C.R. - 6.0, Rear Axle Ratio - 4.73
C.R. - 6.0, Rear Axle Ratio - 4.45
C.R. - 5.0, Rear Axle Ratio - 4.73
C.R. - 5.0, Rear Axle Ratio - 4.45
12 PERCENT GRADE
CAR SPEED-MILES PER HOUR
DISTANCE IN FEET ON GRADE

LEFT: HILL CLIMBING. *Two compression ratios—two gear ratios. On a 12% grade with compression ratio at 5 to 1, and gears at 4.73, the car under test gained speed gradually. With 4.45 gear ratio it could only maintain constant speed. With 6 to 1 compression ratio the hill climbing ability with 4.45 gears was better than 4.73 gears at the lower compression ratio. With* high *compression and 4.73 gears, performance was outstandingly better.*


HORSEPOWER
Maximum Engine Horsepower, 7 to 1 Ratio
Maximum Engine Horsepower, 5 to 1 Ratio
Horsepower Required On Level
CAR SPEED, MILES PER HOUR

BELOW: BEARING PRESSURES. *The mean resulting pressure on the crank pin bearings is* less *at higher speeds with high compression ratios than with low compression ratios. At low speeds, crank pin loads present no problems.*


MEAN CRANK PIN PRESSURES VS R.P.M. FOR 5.5 to 1 AND 7 to 1 COMPRESSION RATIOS AND INERTIA
INERTIA
5.5 to 1
7 to 1
MEAN CRANK PIN PRESSURE-POUNDS
REVOLUTIONS PER MINUTE


5.25 to 1 COMP. RATIO
7 to 1 COMP. RATIO
TIME IN SECONDS TO ACCELERATE FROM 5 MILES PER HOUR
SPEED AFTER ACCELERATION FROM 5 MILES PER HOUR

ABOVE: ACCELERATION. *With 5.25 to 1 compression ratio a given car accelerated from 5 miles per hour to 45 m. p. h. in 18 seconds. With a 7 to 1 ratio, the same car accelerated from 5 m. p. h. to 45 m. p. h. in only 14 seconds.*

ABOVE: HORSEPOWER. *Comparing a 5 to 1 compression ratio with a 7 to 1 ratio for a certain light car shows that higher compression develops approximately 15% greater horsepower at any given speed and reaches 4 miles an hour higher top speed. The greater reserve power of higher compression is invaluable during hill climbing and acceleration when passing other cars.*

AUTOMOTIVE INDUSTRIES

Vol. 66, No. 19 • THIRTY-THIRD YEAR • May 7, 1932

One Dealer—Multiple Lines; That's How Tide Runs Now

Dealers spread their overhead thinner by taking on additional lines when business conditions are poor

by Leslie Peat

BUSINESS gets bad. Dealers go out of business. Those remaining take on more than one car in an attempt to spread the overhead thinner.

That's what has happened every time the sales curve takes a big swing. When sales improved the number of retailers handling one car make exclusively increase. When they declined, those handling more than one make grew in number.

And 1931 was no exception to that rule. There were nearly 9000 less automobile dealers in business at the beginning of 1932 than at the beginning of 1931. During two years of depression about 20,000 dealers actually went broke, but some new ones came in—net result about 9000 decrease during the past year.

But the number of dealers handling more than one make of car actually increased by 1363 during that same 12-month period!

Multiple-car dealers constituted 27 per cent of the total dealers operating at the end of 1931, whereas they constituted only 21 per cent at the end of 1930; 20 per cent at the end of 1929, and 21 per cent at the end of 1928. We have to go back to 1927 when business was on the down grade previously to find the time that multiple-car dealers previously constituted 27 per cent of the total. (See accompanying table.)

Whether business continues bad or gets better, there are indications that this trend toward a greater number of dealers handling more than one make will continue and will not turn back on itself as it did in the business upturn following the 1927 sales dip. . . . But more of that later. One more striking fact must first be recorded from this analysis just completed of the Chilton Class Journal Co.'s Trade List, the most complete and accurate roster of automotive retail outlets in existence.

Here it is:

Chevrolet and Ford have maintained their dealer positions almost unscathed by the depression.

Chevrolet has some 500 more dealers than it had in 1928 and almost the same number as in 1929 and 1930.

Ford, despite declining production and rumors of new models through the latter months of 1931, closed the year with only a slight net decrease for the 12-month period and actually had a greater number of retailers under contract than he had at the end of 1929.

The net declines in dealer outlets came, therefore, from other than these two giants of the low-priced

Data for this study were obtained from the Chilton Class Journal Company's Trade List, the most competent source for motor vehicle retail outlets extant. For years the company has kept its lists up-to-date for its Direct Mail Division, constantly making thousands of corrections of names and addresses of 127,000 dealers, wholesalers and manufacturers in the automotive industry.

field. Detailed study of the figures, in fact, shows that during the depression year of 1931 the number of retail outlets were increased only by Plymouth, Chrysler, Auburn, Studebaker, Reo and Pierce-Arrow. Some other changes undoubtedly have occurred within the last three months which probably would show definite improvement since the beginning of 1932 on the part of such companies as DeSoto, Graham and perhaps others.

By and large, however, the figures show clearly that the middle and high priced fields have been hardest hit from a dealer standpoint. They indicate, too, that those companies which have waged the most aggressive trade paper advertising and direct mail dealer campaigns during the depression period have been best able to run counter to the downward trend.

Factors Influencing Trend

Two factors influence the sweep toward multiple-car dealerships during low sales periods:

1. Desire of the dealer to get more lines over which to spread his overhead;
2. Less pressure from manufacturers on dealers to maintain exclusive setups; needing dealers even worse than usual the manufacturer is not in a position to dictate to the dealer what the latter shall or shall not do.

These factors have always operated in the past to this same end under similar conditions. But, in the past, the proportion of exclusive dealerships has always risen again when business began to pick up.

Will the same thing happen again?

We think not—at least, not to the same extent as heretofore.

It's going to be a long while, to begin with, before the industry gets back to sufficient volume to make exclusive dealerships profitable except in the lowest priced lines or in the larger urban communities. Automobile selling has reached very near to the stable commodity stage. Good profits remain to be extracted from it in the future; but good profits probably never again will flow from it in a golden stream.

Manufacturers realize this. And they realize as never before that their very lives depend on the financial stability of their dealer organizations.

The result is that every current merchandising move by important manufacturers seems tending toward a greater rather than a smaller development

(Turn to page 690, please)

How Dealers Who Survive Take On Additional Lines

	1926 Per Cent of Multiple Dealers	1927 Per Cent of Multiple Dealers	1928 Per Cent of Multiple Dealers	1929 Per Cent of Multiple Dealers	1930 Per Cent of Multiple Dealers	1931 Per Cent of Multiple Dealers
Ala.	20	21	18	20	15	20
Ariz.	33	33	25	23	19	20
Ark.	27	21	15	13	17	16
Calif.	29	27	21	19	25	17
Colo.	30	24	19	18	21	23
Conn.	30	30	18	21	22	33
Del.	29	30	40	37	41	36
D.C.	17	9	5	4	5	17
Fla.	26	24	18	19	21	25
Ga.	19	19	18	13	14	14
Idaho	33	39	24	24	24	32
Ill.	30	27	19	17	19	32
Ind.	24	20	15	17	18	26
Iowa	39	32	23	22	20	23
Kan.	22	19	15	15	18	24
Ky.	24	22	16	29	21	25
La.	26	21	14	12	13	18
Me.	20	28	16	16	20	20
Md.	34	32	15	18	18	26
Mass.	29	26	14	14	16	20
Mich.	33	33	31	24	25	30
Minn.	38	33	24	24	29	30
Miss.	19	14	19	18	16	25
Mo.	20	16	13	13	11	19
Mont.	42	37	29	26	23	33
Neb.	30	28	26	25	25	27
Nev.	59	48	32	32	36	41
N. H.	41	30	18	22	22	24
N. J.	27	26	19	20	20	29
N. M.	29	24	22	22	20	19
N. Y.	34	28	22	20	24	27
N. C.	23	21	19	18	18	33
N. D.	47	43	26	22	27	18
Ohio	42	25	21	19	19	32
Okla.	19	13	16	14	15	17
Ore.	33	24	24	21	24	36
Pa.	33	30	23	22	25	30
R. I.	29	33	19	18	25	33
S. C.	22	18	13	13	18	20
S. D.	40	38	29	24	26	33
Tenn.	19	15	13	13	16	21
Tex.	18	13	15	14	16	21
Utah	36	30	23	26	22	27
Vt.	47	43	20	20	20	28
Va.	32	29	26	25	19	20
Wash.	38	35	28	29	21	30
W. Va.	33	29	23	26	25	35
Wis.	41	35	32	30	26	30
Wyo.	48	45	28	29	26	25
U.S.Total	31	27	21	20	21	27

The Shift Toward Multiple Dealerships

	1926	1927	Per Cent Change 1927 Over 1926	1928	Per Cent Change 1928 Over 1927	1929	Per Cent Change 1929 Over 1928	1930	Per Cent Change 1930 Over 1929	1931	Per Cent Change 1931 Over 1930	Per Cent Change 1931 Over 1929
Multiple Dealers	41,799	16,923	— 59%	22,558	+33%	10,192	—55%	9,972	— 2%	11,555	+15%	+13%
Exclusive Dealers	18,579	45,464	+145%	40,314	—11%	41,368	+ 3%	37,172	—10%	31,326	—16%	—24%
Total Dealers*	60,378	51,440	+ 3%	50,984	+ 1%	51,560	—18%	47,144	— 9%	42,881	— 9%	—17%

*Without duplication.

Just Among Ourselves

The Battle of the Cylinders

WE'RE going to hear a good bit about "The Battle of the Cylinders" within the industry this year, because Ford has an eight, Chevrolet a six and Plymouth a four and because a certain amount of advertising of these companies will continue to be built around the efficacy of the particular number of cylinders in the particular car doing the advertising.

We're likely to hear so much about it — talking to ourselves within the trade—that we will go astray as regards the actual importance of this single factor in the sale of cars. Just sit around some time, you automobile men, and listen to doctors, lawyers, Indian chiefs and their wives talk about possible automobile purchases and get a load of the order of importance of the different sales points as they discuss them. We've been doing that a little bit lately, keeping very quiet ourselves in order not to lead the conversation.

And the Point of Contact Is—

WE heard a doctor and his wife talking about the three cars mentioned along with DeSoto and Pontiac — they were definitely in the market for one of the two larger cars. The conversation went on for at least five minutes before either of them mentioned number of cylinders in any manner. Then the doctor made a casual reference to the Fords having eight cylinders.

This particular couple definitely showed the effects of having had two of the cars demonstrated adequately—one of them exceptionally w e l l — a n d had practically decided on the purchase of the highest priced of the group they had been considering because of appearance, smoothness, comfort and what they considered to be individuality. Asked about the allowance given on his old car, the doctor replied: "The dealer from whom we are going to buy offered us less than his next cheapest competitor, but both offered plenty."

The actual battle for sales is often fought on grounds quite different from those generally accepted by dealers and manufacturers.

A Research Job Is Open

WHICH leads us to the none-too-new thought that somebody some day is going to do a real job of consumer research in the automotive field. When that job is done it will embody sound psychological as well as statistical principles. It will recognize the fact that the motives which really actuate a man can rarely if ever be discovered by direct questioning. It will start with some of the fundamentals used by Macy's recently when that big store based a big annual sale on a new t y p e of investigation among housewives. (Every automotive research man and sales executive should be familiar with the *methods* used in that survey.)

Cost is an overwhelming factor hindering such research in most automotive concerns today, but if it could be continued and amplified it might well return its cost manifold in the future—that is, provided the study has the understanding of the management in its inception and provided that the management uses its results for practical guidance. But before plunging into consumer research, the first thing needed is thorough s t u d y of methods; they've been wrong for the most part in the past.

The Dealers Need It

MANUFACTURERS have been crying loudly for years against padding of delivered prices. Gradually the outcry has subsided as the years went by until now in the spring of 1932 it's just about a hoarse whisper.

Long since have most manufacturers conceded the dealers' right to a mark-up on freight charges, a dealer demand which met with harsh opposition only a few years back. There has been some swing back from the completely-equipped-car idea, so that on some makes the dealer is getting a little better chance than he had for a few years to cash in on accessory sales at the time the new car is sold.

It's quite possible that some extra "reserves" may be set up in the finance charges on some makes before long as another means of getting a few more dollars into the dealer's gross and thus giving him a little better chance to earn a decent living. Factory executives in general would have professed to be horror struck at any such proposal a few years ago, but some of them at least will be found promoting the idea today. The idea is gaining headway at factories that the dealer must be put on a profit-making basis by any legitimate means possible.—N.G.S.

Rigid Inspection of Tools and Product

Muncie Products Division checks all gear hobs for lead, pressure angle, face of gash, spacing of gash, concentricity, diameter of bore and hardness as one of the steps necessary to produce gears that are silent in operation and capable of carrying maximum loads

ACCURACY of machining operations and close tolerances on material specifications and heat treatments are some of the most important requirements in the manufacture of modern automobile transmissions. These requirements, moreover, have become more rigid every year. Accuracy in gears is necessary because of its effects on both silence of operation and strength of gears. Since the introduction of transmissions with so-called silent-intermediate gears, about four years ago, public attention has been focused on transmission performance from the standpoint of noise, and, as a result, increasing demands have been made on the manufacturers.

Greater accuracy has become necessary also through the increase in engine speed and horsepower. On the whole, automobile transmissions are no larger now that passenger car models average above 100 hp., than they were 10 years ago, when engine power was not one-half as great and engine speeds were materially lower. Stresses in the teeth of high-speed gears result largely from the so-called dynamic load, which is due mainly to inaccuracies of tooth form and spacing. These dynamic loads increase with the speed and the magnitude of tooth errors, and to make up for the effects of increased speeds it has become necessary to reduce the errors; that is, to work to closer limits.

View in gear forging department showing heating furnaces and upsetting machines

The writer recently had the privilege of visiting the plant of the Muncie Products Division of General Motors Corp. at Muncie, Ind., and to observe and take notes on some of the methods which have been introduced there in recent years to cope with the new demands in the transmission field. This organization, which has been specializing in the transmission line for nearly two decades, now turns out gear sets for Pontiac, Oldsmobile, Marmon and Stutz cars, and for General Motors and Dodge trucks, hence its experience extends over a wide range of requirements.

The following statement bearing on the problem of accuracy required in modern transmission gears, and methods of attaining it commercially, was made to the writer by Fred W. Cederleaf, works manager:

"On assembling and testing 10 gear sets made up by an outside concern we found six sets passable and four sets too noisy. This test gave us a pretty good idea of the size of the job. As finishing by grinding was out of the question on account of cost, our only alternative was to lap. Whereas it is practical to remove 0.003 to 0.010 in. by a grinding operation, lapping of gear teeth is successful only when it is called upon to remove from 0.0002 to 0.0005 in. of material.

"This meant that we must send to the lapping operation gears which not only have contours and spacing within 0.0005 in. of the proper dimensions, but which also are concentric within this limit, because should a gear run out 0.002 in. when presented to the rotary lap, it would be necessary to remove all of this eccentricity from one side of the gear before the lap would start to touch the other, the low side; and, as mentioned above, when the lap is called upon to remove more than 0.0005 in. of material, it not only increases the length of time of lapping but also destroys the lap profile, defeating the very purpose it is intended for."

At the Muncie Products plant all gear blanks are made from bar stock, which arrives at the plant cut to such lengths as to give a certain number of blanks with a minimum amount of waste. All blanks are made by the upsetting process. Two grades of steel are used for the transmission gears, chromium steel for passenger-car transmissions, and nickel steel for truck transmissions. The former corresponds to S.A.E. steel No. 5140, except that the carbon range is held within five points, while the nickel

Assures Accuracy in Gear Production

by P. M. Heldt

steels are of the low-carbon, case-hardening type and contain either 3½ or 5 per cent nickel.

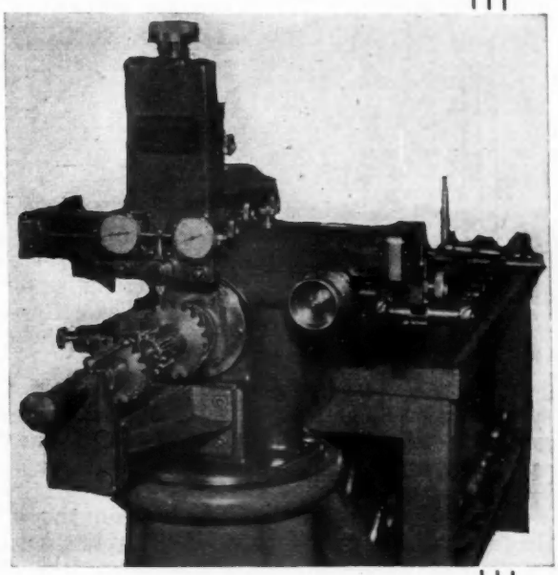
Every precaution is taken to prevent the steel from becoming contaminated in the course of its passage through the shops, and after the bars have been heated for upsetting, they are carefully cleaned of scale before they are inserted into the bulldozer. A rather unusual part for production in a bulldozer is the blank for the cluster gear, which comprises a sleeve portion with three enlargements for the three gears upon it. This blank is formed in two heatings. All of the gear blanks, including the cluster gear, are pierced in the bulldozing machine, and the holes are finished by broaching, in some cases after preliminary drilling. Removal of the scale from the heated bar before forging also assures better machining qualities.

After forging, all of the blanks are normalized to remove forging strains and to improve the machining qualities. They are then tumbled and grit-blasted, which is accomplished in a single operation in revolving steel barrels half-filled with parts, into which a grit blast is directed through one of the tuyeres around which the barrel revolves.

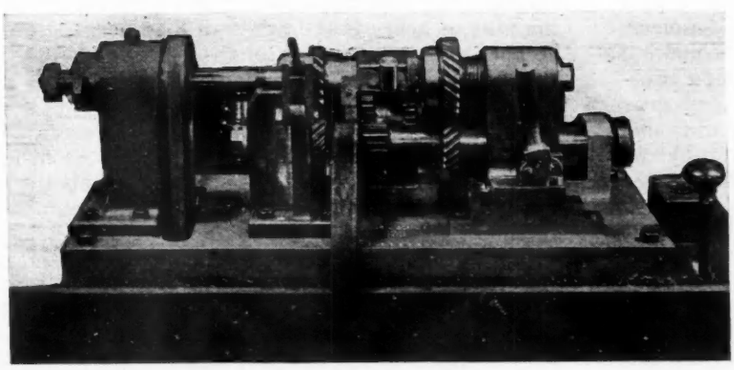
The machine work on the blanks is done for the most part on automatic lathes. The spool gear forming the reverse idler, for instance, is first broached out from the rough and has three keyways broached at the same operation, these keyways being used only for driving in the machining and gear-cutting operations. The blank is then turned up in automatic lathes, one machine being used for roughing and another for finishing. These machines are arranged to face each other, and both are looked after by one operator. There is an arbor press close to the automatics for use in inserting and removing the arbors, and the operator is provided with caliper gages for checking the accuracy of the machining operations. After the blank has been turned up it is centered, and all subsequent operations on it are effected on centers.

Another important part, in so far as machining operations are concerned, is the sliding sleeve, which is machined up from bar stock. It is formed, bored and cut off in the automatic, and is then broached with three internal keys. These keys are of involute (instead of straight-sided) form, and it is the practice of Muncie Products to use involute keys or splines wherever both of the parts connected are of its own manufacture, since it considers this type of spline to possess definite advantages. In the case of the two shafts protruding from the transmission housing, the clutch shaft and the main driveshaft, standard straight-sided splines are used, since these must match splined parts manufactured elsewhere. Next the sleeve is rough-turned.

The splined sleeve has three radial slots at each end, forming recesses into which arms on the synchronizing



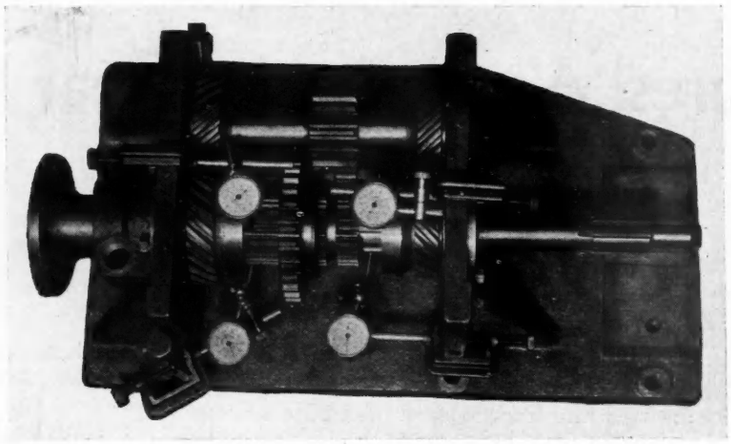
Involute contour-checking machine, one of the pieces of equipment in the gear laboratory



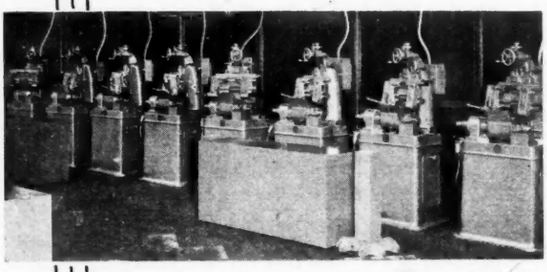
Specially built gear - mating stand
(On this stand gears are paired selectively to obtain smooth-running characteristics)

Deflection-test fixture

(In this fixture torsional load is applied to the driveshaft and the deflections of various parts of the transmission are determined by means of dial gages)



Battery of gear-lapping machines



drums may enter. These slots are milled, one at a time, with an indexing fixture on a milling machine. Next, the corners of the sectors between slots are milled off to form the cam surfaces of the synchronizing mechanism.

This sliding sleeve has involute splines cut on its outside on which slides the low-speed gear. These splines are similar to involute gear teeth, except that they are of less depth, and they are formed by hobbing with regular involute cutters.

The low-speed gear, which slides on the sliding sleeve, is broached with 24 integral involute keys corresponding to the spline grooves on the outside of the sliding sleeve. Those involute keys, by the way, have a pressure angle of 27½ deg. Where an involute key is used, the pressure on the key is not tangential to a circle through the line of contact, but makes an angle with the tangent line equal to the pressure angle. Hence the pressure has both a tangential and a radial component and the radial component has a tendency to center the gear on the shaft or sleeve. By making the pressure angle comparatively large, this self-centering effect is accentuated. Two of the low-speed gear blanks are placed on an arbor and rough-turned in one automatic and finished in another, the two machines being placed face to face as previously described. After finish-turning is completed, the arbor is removed in a conveniently located arbor press and a light facing cut is taken at the side of the gear around the edge of the pilot hole in it to remove the burr.

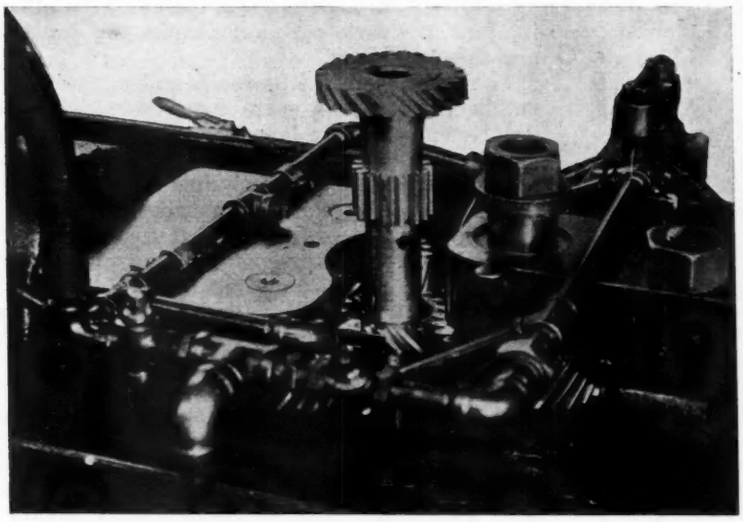
The blank is next counterbored under the fork slot so that this portion of it will not contact with the sliding sleeve. The reason for this is that, owing to the comparatively small depth of metal, there will be more contraction of the bore at this portion than within the gear proper. Therefore, if the splines were left in inside the fork groove, the splines after heat treating would not be absolutely parallel, which would tend to cause "slip-out" of the gear in operation.

The idler gear blank has its teeth roughed out in a hobbing machine and finished in another machine of the same make. This and the central gear on the cluster are the only gears that are roughed and finished successively, all other gears having their teeth cut in one operation. In hobbing the teeth on the cluster gear and the idler gear, the blanks are mounted on centers and driven by means of expanding keys, as illustrated by one of the drawings herewith. The head center of the hobbing machine has a cylindrical extension entering the bore of the work with a certain amount of clearance, and the work is centered exclusively by the conical surfaces of the head and tail centers. In the cylindrical extension of the head center there are three keys which are adapted to slide radially, and these are forced outward into contact with the bore of the blank by the tapered head of a draw-in rod, which is operated by an air cylinder attached to the hobbing machine.

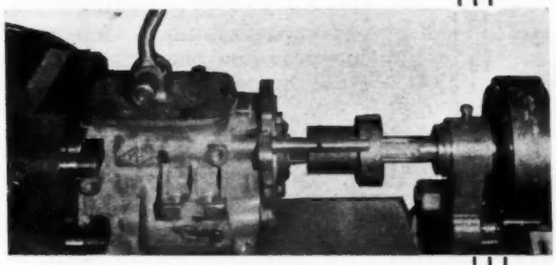
All gears to which the hobbing process is applicable are hobbed. Gears too close to others of large diameter, and the internal gears which form members of the positive clutches for the high and intermediate speed gears, are cut on the gear shaper.

After the gears have been cut, and before they are sent to the hardening department, they are slightly burnished. To this end they are placed between three other hardened and ground gears which are pressed against them by means of an air cylinder, and while the nest of gears is thus pressed together, the gear to be burnished is turned through about two revolutions. This has the effect of removing any burrs on the gears and of smoothing down the tool marks. No effort is made in this operation to correct any errors of tooth contour and spacing, or of concentricity. Both helical and straight spur gears are subjected to this burnishing process. The teeth of gears which in the operation of the transmission are slid into engagement by an axial movement are chamfered in a tooth-chamfering machine.

To prevent deformation of the contours of teeth in transportation, and especially during the heat-treating process, the gears are placed individually on racks so



The burnishing fixture in which a newly cut gear is run between a set of three hardened and ground gears pressed against it by an air cylinder



Dynamometer test stand with transmission in inspection booth

they cannot touch other gears. One of these racks is illustrated herewith.

All helical gears are cut with hobs of 17½-deg. pressure angle, which gives the gear teeth a pressure angle in the transverse plane of from 20 to 23 deg., according to helix angle. Using a constant normal pressure angle has the advantage that all hobs used can be of standard size and shape. When helical gears are checked for contour, the contact point of the contour-checking instrument passes over the tooth in the transverse plane, however.

All hobs used for cutting teeth have straight sides without tip relief or flank modification. Stub teeth are used throughout, and it is felt that with the large pressure angle and low-depth teeth, deflection of the teeth under load is so minute that tooth modification to prevent interference is not required. However, the shape of the gear is altered somewhat by the heat treatment, and this is duly provided for. The chromium steel used for the gears of passenger-car transmissions has the characteristic of expanding on being heated in the cyanide bath and quenched. This is allowed for by grinding the cutting surface of the hob teeth at a slight angle to the radial. Since the hob tooth is "relieved," if the tooth is ground back near the root, or "hooked," the pressure angle will be reduced, whereas grinding the hob tooth back near the tip, or "dragging" it, has the opposite effect. Expansion of the gear during heat treatment has the effect of modifying the pressure angle, and this effect can be neutralized by grinding the cutting surface of the hob tooth off the radial. Nickel steel contracts on being given the heat treatment, and hobs intended for cutting the gears made of it must therefore be given the opposite modification. It should be understood that the modifications required are very slight.

All hobs are ordered to meet *A* tolerance specifications, and upon receipt at the plant they are checked for lead, pressure angle, face of gash, spacing of gash, concentricity, diameter of bore and hardness. Acceptance is made dependent upon meeting the *A* tolerance specifications.

In hobbing a gear only a portion of the width of the hob is used, and when that portion has become dull, the hob is moved sideways on the arbor and a new section is brought into action. This can be done three or more times, according to the pitch diameter of the gear cut. After the whole width of the hob has been dulled by cutting, the hob is reground, and after each regrinding the gash face and gash space are rechecked. When the hob is mounted in the machine it is checked for runout, which must not exceed 0.0003 in. by indicator reading.

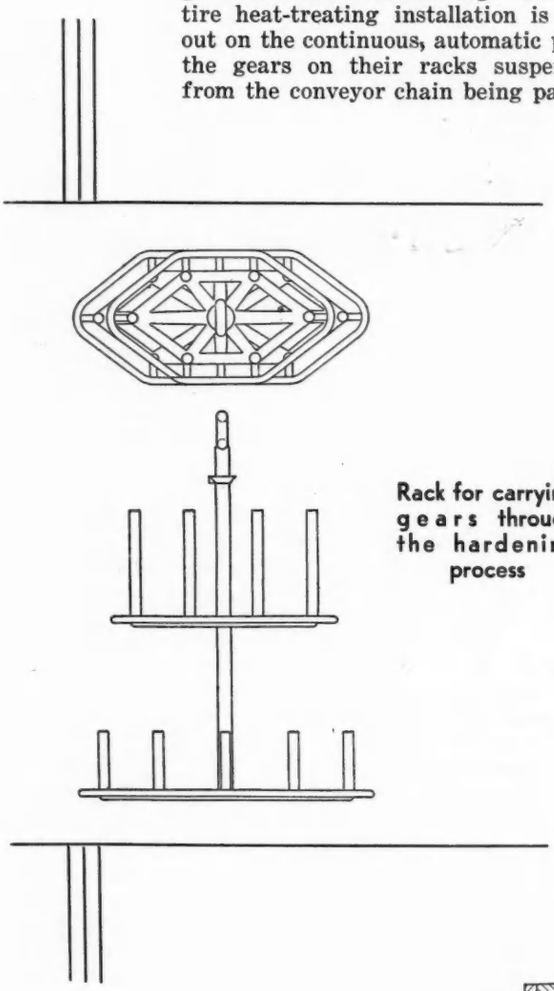
Every set-up of a generating machine and every movement of the cutter on the machine must be approved by the gear laboratory. The first gear cut on a new set-up is handed into the gear laboratory and checked for tooth spacing, tooth contour and concentricity, and if it is found satisfactory, the Red Liner chart, which shows its characteristics, is stamped with the date, time, and gear data and is then filed. After 10 gears have been completed, another is sent to the gear laboratory and checked, and its record is filed.

After being hobbed and having the teeth chamfered, the gears are given a light burnishing operation before they are subjected to the heat treatment. Specimen gears are returned from the burnishers to the gear laboratory at frequent intervals for checking. With this rigid supervision it is possible to keep errors of contour and spacing within 0.0005 in. and the eccentricity within 0.001 in. (0.002 in. runout); and these results are accomplished by cutting teeth in one operation, with approximately 0.060 in. feed per revolution of the work.

All internal gear-type clutch members are cut with the same degree of accuracy as the spur and helical gears, and they are checked for errors of spacing, contour and concentricity on a specially designed rolling

fixture which is based on a principle similar to that of the Red Liner. The splined shafts with involute splines, which latter have a pressure angle of 30 deg., are generated with a straight-sided hob. All splined shafts are checked for accuracy of section by cutting specimens from them, about ¼ in. thick, and by means of the Bausch & Lomb comparator comparing their shadow with a chart of 60 times actual size.

All gears of chromium steel are hardened by cyaniding. They are placed individually on the racks of which an illustration is shown below, and these racks are hung onto a chain conveyor which passes through the bath of molten cyanide. The bath is of annular form and the parts are moving continuously while passing through it. The cycle in the cyanide bath can be made either 26 or 39 minutes. After coming out of the cyanide bath the gears are successively quenched in oil, passed through a soda solution and an electrochemical cleaning solution. Then they are subjected to a hot-water rinse, after which they pass on into the drawing oven. These gears are drawn at 425 deg. The entire heat-treating installation is laid out on the continuous, automatic plan, the gears on their racks suspended from the conveyor chain being passed successively through the cyanide bath, the oil-quenching tank, the various cleaning tanks, the drawing oven and the draw tank.



Rack for carrying gears through the hardening process

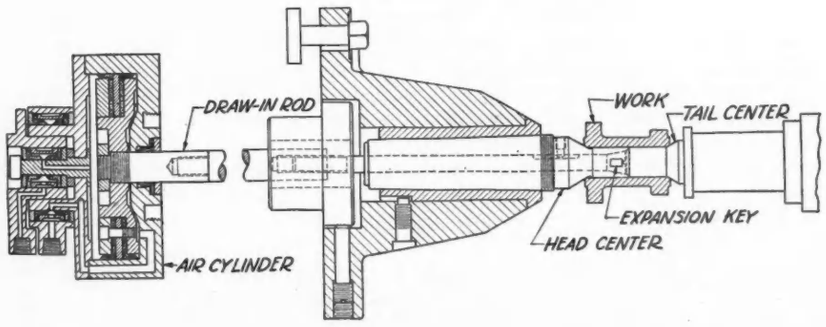
To remove slight inaccuracies and surface roughness on the teeth as the gears come from the hardening department, they are lapped, and a battery of lapping machines installed in the plant is illustrated herewith.

At the end of the assembly line there is a test stand on which each assembled transmission is placed and run under brake load to check it for smoothness and silence of running, ease of shifting into every gear position, etc. Previous to making this test the transmission has been filled with lubricant. This test is made under the control of the production department. As the transmission is taken off this test stand it rolls down a gravity conveyor into a test booth, where an identical test is made, this one, however, by the inspection department.

A considerable amount of testing equipment for developmental work is available at the plant. For endurance tests, the transmissions are driven by electric motors and the power is absorbed either by a "club" outside the building, as in tests of airplane engines, or by an electric generator. There is a silent room inside the testing laboratory with a stand adapted to take a transmission. Driving and driven shafts extend through the walls of the room and connect to the electric motor and generator outside through a multiple V-belt drive each. This makes it possible to obtain the proper speeds of the driving and driven shafts for any desired test by merely changing the belt pulleys.

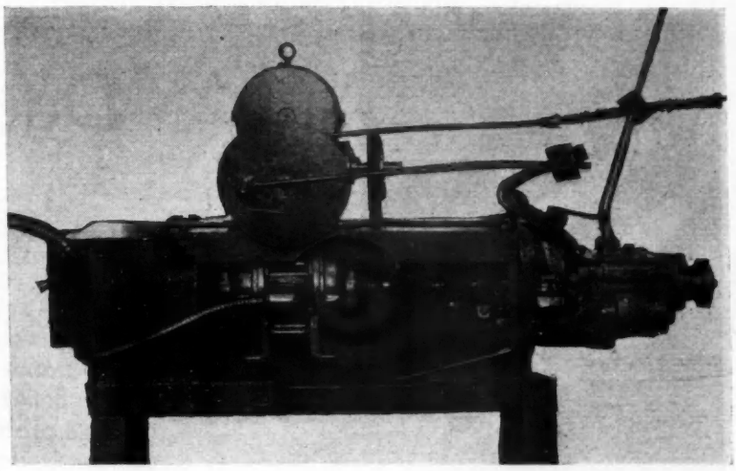
There is also a so-called four-square testing stand, on which a pair of transmissions are connected up end to end, so that the power is transmitted through one of them in the normal and through the other in the reverse direction. The two projecting shafts of the transmissions are connected up by a shaft running parallel with them, which is put under torsion by means of a flanged coupling. In this way endurance tests under full-load conditions can be made by supplying from an outside source only sufficient power to equal the loss in the two transmissions.

Another testing arrangement, of which an illustration is shown herewith, was designed specially to check the endurance qualities of the shift mechanism. An electric motor through a belt drive and a worm gear-type speed reducer turns a crank disk from which a link connects to the shift lever of a transmission mounted on the machine. There is another crank disk which is driven from the former through gearing at twice the speed, and a link from its crank connects to the clutch pedal. Thus the clutch is disengaged before either the direct drive or the second speed is engaged by the shift lever. While the testing machine is in operation the gears of the transmission are being

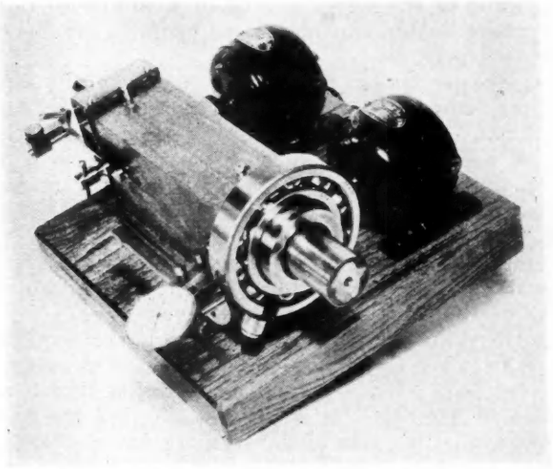


Method of holding idler gears between centers and driving by air-operated expanding keys

revolved, but, of course, they transmit no power. Six shifts are made per minute. The object of this test is to check the endurance qualities of parts affected by gear shifting, particularly those of the gear-synchronizing mechanism.



Machine for making endurance tests on shifting mechanism



The ends of the spindle projecting from the journal constitute gages for the bores of the various bearings inspected

Gisholt Designs Fixture for Testing Bearings

NO doubt many users of ball bearings will be interested in the fixture designed recently by the Gisholt Machine Co. for inspecting the bearings used on Gisholt balancing machines. The method described here is a fine approach to the solution of an important mechanical problem.

This fixture consists of a spindle driven by fractional horsepower motors through worm gearing and mounted in a journal on the outside of which are suitable attachments to locate and support a dial indicator in the necessary positions. The ends of the spindle projecting from the journal constitute slightly tapered gages for the bores of the various bearings inspected.

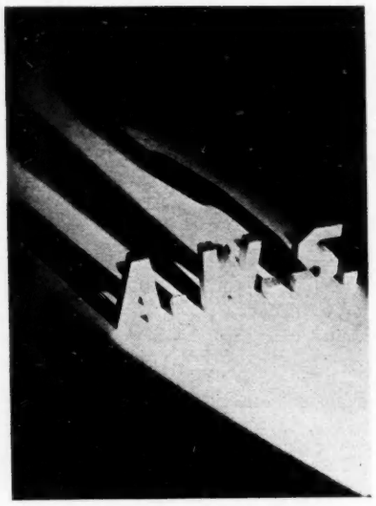
After checking the outside diameter by a comparator arranged to read to 0.0001 in. and checking the width by means of a micrometer caliper, the bearing is slipped up on the tapered portion of the spindle where two lines indicate the permissible smaller and larger limits of the bore. A bearing which will not pass over the first line or which passes beyond the second line is rejected as having a small or large bore respectively.

With the bearing firmly seated on the spindle the radial runout or eccentricity is observed by means of a dial indicator placed against the outside diameter while the inner race is rotated at 58 r.p.m. and the outer race held stationary. The slow speed of rotation and the use of an indicator reading to a tenth of a thousandth of an inch, permit very accurate inspection.

The longitudinal runout is observed in the same manner with the dial indicator reading from the face of the outer race.

Inspecting the ball bearing for friction and the presence of foreign matter is of too great importance to be left to the sense of feeling in an inspector's hands or to his individual judgment. For each different size of bearing, certain maximum and minimum weights are specified for this phase of the inspection. With the bearing mounted upon the spindle, the smaller weight is attached to the outer race by means of a spring clip and the spindle is then rotated at a slow speed by the motor. To pass inspection the outer race must rotate with the inner race, carrying the weight around with it, which shows that the bearing is closely fitted and can have no radial play.

Passing this requirement, the larger weight is substituted for the smaller and the spindle is again rotated slowly. To indicate that the friction is not excessive, this weight must prevent the outer race from rotating with the inner. This test is continued for about two minutes during which the presence of foreign matter will be detected by sporadic rotation of the outer race with the inner race in spite of the restraining influence of the weight.



Ductility and Corrosion

by Joseph Geschelin

Ductility is secondary in good design, according to paper by J. H. Critchett, Union Carbide. Belief that spot-welder is on the way out as a production machine in certain applications is decried by P. W. Fassler. Possibility of extending series method of welding is discussed

ONE of those sessions bristling with controversial angles was the high spot of the annual meeting of American Welding Society last week. The thing that packed them in to the rafters was a symposium on Ductility in Welds, participated in by many outstanding people in the field of materials. Surprising how much diverse opinion is held on this seemingly settled question. It was summed up in particularly able fashion by J. H. Critchett of Union Carbide and Carbon, who said that the evidence shows ductility to be secondary to good design.

To an automotive man it might appear that a better percentage of the papers could have been devoted to the developments in his field. Nevertheless, the proceedings hold much of interest to automotive production men. Certainly such papers as those on Ductility, and the one on Corrosion by Dr. Mathews, add much to the literature in the field. Then there were several dealing exclusively with automotive problems.

P. W. Fassler, well-known welding expert, presented an interesting appraisal of welding machines in his paper, Modern Spot and Relief or Projection Welders and Their Application to Production Problems. In particular he decried the feeling that the spot welder may be on the way out as a production machine on certain applications. He said in part: "The writer is entirely out of sympathy with this viewpoint, for he feels that there are certain applications to which the spot welder is particularly suited. The spot welder will always be found on small production operations for the reason that the projection welder is essentially a high production machine. Furthermore, the initial cost of the projection welder is too high to allow it to enter into competition with the spot welder in this field."

Another point was the possibility of extending the application of the series method of welding—so valuable where design considerations prohibit the use of a lower electrode.

Mr. Fassler speaks from experience when he says that the knowledge of the theory of operation and maintenance of modern welding equipment on the part of users has not kept pace with the growth of usage, in consequence of which manufacturers are forced to give much service that could be dispensed with.

In discussing projection welding, the author gives some interesting tabular material in Fig. 1, which shows design data based on wide experience.

Another paper reflecting current automotive practice is by Carl DeGanahl, president of Fleetwings, Inc., entitled, Spot Welding of Stainless Steel as Applied to Aircraft. It is pointed out that the 18-8 stainless steel is particularly suitable for spot welding and has good forming qualities even when hard rolled or cold worked. It is preferable to use material with a tensile strength around 175,000 lb. per sq. in. and elongation of not less than 6 per cent. A peculiar property of the 18-8 steel is the fact that it can be annealed by heating to a high temperature and quenching. In this respect it behaves much like copper.

Fleetwings, it will be recalled, makes a wide variety of aircraft structural members such as tail surfaces, ailerons and wings, all fabricated of stainless steel, spot welded.

The important problem from the point of view of welding stainless steel is corrosion. Heated to

Fig. 1—Recommended Proportions for Projection Welding

Embossments in:		Welded to: 20GA—0.0375		18GA—0.0500		16GA—0.0625		11GA—0.125		7GA—0.1875		3GA—0.250	
Gage	Thickness	Diam. of Emb.	Height of Embossment	Diam. of Emb.	Height Embossment	Diam. of Emb.	Height Embossment	Diam. of Emb.	Height Embossment	Diam. of Emb.	Height Embossment	Diam. of Emb.	Height Embossment
20GA	0.0375	3/16"	0.040–0.050	3/16"	0.040–0.050	3/16"	0.040–0.050	3/16"	0.040–0.050				
18GA	0.0500	5/32"	0.030–0.040	3/16"	0.030–0.040	3/16"	0.040–0.050	3/16"	0.040–0.050				
16GA	0.0625	5/32"	0.030–0.040	5/32"	0.030–0.040	5/32"	0.030–0.040	5/32"	0.040–0.050	3/16"	0.040–0.050	3/16"	0.040–0.050
11GA	0.125	5/32"	0.030–0.040	11/64"	0.030–0.040	11/64"	0.030–0.040	11/64"	0.040–0.050	3/16"	0.040–0.050	3/16"	0.040–0.050
7GA	0.1875	3/16"	0.030–0.040	11/64"	0.030–0.040	11/64"	0.030–0.040	3/16"	0.040–0.050	3/16"	0.040–0.050	3/16"	0.040–0.050
3GA	0.250	3/16"	0.030–0.040	3/16"	0.030–0.040	3/16"	0.030–0.040	3/16"	0.040–0.050	3/16"	0.040–0.050	3/16"	0.040–0.050
13GA	0.093	5/32"	0.030–0.040	11/64"	0.030–0.040	11/64"	0.030–0.040	11/64"	0.040–0.050	3/16"	0.040–0.050	3/16"	0.040–0.050

in Welding Up at A.W.S. Meeting

a temperature of 500 to 900 deg. C. the carbon tends to come out of solution and combine with chromium, "forming chromium carbide which concentrates along the crystal faces in the metal, and when this occurs the steel ceases to be stainless and becomes subject to a type of corrosion which is exceedingly dangerous. When corrosion sets in on such a piece of metal, it follows down the crystal faces into the heart of the metal causing what is called an "intergranular corrosion," with the result that the metal tends to disintegrate and fall to pieces."

The answer lies in a spot-welding technique giving a high temperature for a minute interval of time. This has been accomplished by electric welding, utilizing a new type of contact point for the electrode and suitable welder controls recently developed. A short time ago Budd announced similar results with a process which they call "shot" welding. This development has been noted in *Automotive Industries.*

Machine gas welding for certain types of work was described by J. L. Anderson of the Air Reduction Co. At present, automotive applications are limited to the production of tubing of various kinds; one wide use is in the manufacture of tubing for the propeller shaft where the stress is specified in the order of 90,000 lb. per sq. in.

Wider applications of the process have been limited by numerous variables, chief of which lie in the quality of the base material. It is found that the steel must conform not only to chemical and physical specifications but must also possess good weldability. It is claimed by the author that the steel mill can supply the requisite material upon request.

To cope with dimensional variations in production, an inspection is recommended prior to welding. By weeding out the non-conforming parts and putting them through a controlled welding process the cost of production can be greatly reduced.

A Welding Production Line

Although the paper on Welding at Electrolux deals with another field of endeavor, it is of interest insofar as it lays down some interesting details of a welding production line. Here is a layout utilizing gas welding almost exclusively. Yet they have found it possible to work out a progressive welding line completely conveyorized. The main attribute of a conveyor line for this purpose is smooth operation—jerks being fatal to good work. This was licked by balancing the conveyor chain with suitable weights.

With the introduction of a conveyor line, production was stepped up 50 per cent with only 20 per cent additional labor.

John A. Mathews of the Crucible Steel Co. reviewed the case of stainless steels in his paper, Cause and Cure of Intergranular Corrosion in Austenitic Steels. The cure for the condition has worked out along three different lines.

"The first method that has been found satisfactory in most cases results from the manufacture of an alloy with the lowest possible carbon content. The solid solubility of carbon or carbides in this steel is extremely low, possibly not over 0.03 to 0.04 per cent. However, with carbon below 0.07 per cent it is usually found that danger of intergranular attack is minimized probably because there is so little carbon to be precipitated upon reheating that no attack occurs or that occurrence would be so extremely slow as to be virtually negligible.

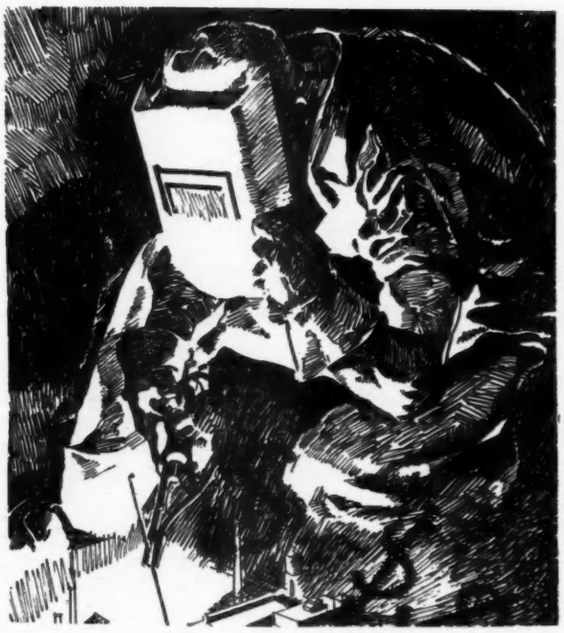
Heat Treating Welded Part

"The second method of prevention that has had considerable application and that is very certain in its effect, results from heat treating all over the welded part. After a weld has been made and presumably carbide precipitation has occurred in the regions adjacent, it is possible to totally remove this effect by reheating to some temperature—usually from 1800 deg. Fahr. or upward, depending upon the amount of total carbon or carbide which must be taken into solution. This high heat treatment also removes stress effects introduced during the process of fabrication and brings about once more a uniform or homogeneous condition throughout the entire part.

"This brings us to the third method of prevention of intergranular susceptibility by the addition of certain other elements to the austenitic chromium-nickel steels which have been found to act as inhibitors to prevent, or very greatly retard, intergranular susceptibility. The exact way in which these elements function has not been explained in all cases but they have been tested sufficiently in the laboratory and elsewhere to prove that they may be extremely effective."

Dr. Mathews' work as usual gives much food for thought. To those working with stainless steels, this paper will provide the explanation to a troublesome question.

(Turn to page 694, please)



One Dealer—Multiple Lines; That's How Tide Runs Now

(Continued from page 680)

of multiple-car dealerships. The General Motors B-O-P setup was not devised for this specific purpose, but its ultimate working out seems almost certain to foster such a movement. Plymouth is going into the hands of more and more Chrysler, Dodge and DeSoto dealers and is helping them materially to build profitable businesses. Hundreds of Studebaker dealers have taken on Rockne and scores of other retailers have combined two or more makes under one roof, sometimes even competitive makes.

The need for a low priced bread-and-butter line on the part of dealers in smaller towns is being talked about more generally each year. Profit-making service and repair work, of course, is now and in the future will be to a greater extent a very important—if not the most important—profit maker for these small-town merchants as well as for many of their metropolitan dealer brethren.

Just where the future sales movements should be directed by makers of middle and high-priced cars who do not have low-priced car affiliations is being debated by the executives of those factories in many a serious conference. If the answer were so simple as "Bring out a low-priced car" there would be little need for debate. But it isn't, obviously. Different backgrounds and different factory setups will prosper best with different treatment of specific marketing problems.

Some executives in this group are thinking in quite radical terms. "There are too many dealers already in a good many places," one enormously successful vehicle company executive opined confidentially not long ago. "It's quite possible that some time in the future people will have to drive nearly 100 miles in order to purchase an automobile. A man doesn't buy an automobile every day and there is no particular point in being able to go around the corner to buy it. When this happens it is quite possible that a car manufacturing company like ours might sell a few less automobiles, but it might be better off under the circumstances because everybody participating in the sale of such vehicles as were sold would make a profit.

"As far as service is concerned," he continued, "it would be quite feasible to rely on the independent service stations. They are doing well over half of all the service now, whether we manufacturers like it or not. And they've been serving the public reasonably well on the average. No reason why they shouldn't continue to do so in the future to an even greater extent. . . ."

This viewpoint is unique rather than typical, but it reflects the breadth to which some thinking on marketing problems is ranging among responsible executives of automobile factories.

In the long run, of course, that method of selling will prevail which produces the best relationship between profit and volume for both factory and dealer. Production of sales is the real answer in the end, in the opinion of most executives. Viewed from this angle, it is interesting to note that the group of states which led in new car sales last year moved more rapidly to the multiple-car dealerships than did the remaining 41 states and the District of Columbia. These seven states (New York, Pennsylvania, Illinois, Ohio, Michigan, Massachusetts and New Jersey) account for about half of the sales made during the past five years. They show a gain of nearly 30 per cent for multiple dealers in 1932 over their own 1929 showing.

California is the only major sales state which shows a decline of multiple dealerships and this is only about 12 per cent, while the decline of all dealerships in that state was about 24 per cent from 1929 to 1932.

Dealer mortality has been exceptionally heavy in Arizona, Delaware, Kentucky, New Mexico, North Dakota, Virginia and Wyoming, carrying with it multiple as well as exclusive dealers, although exclusive dealership deaths in these states have been proportionately heavier than have been losses in multiple dealerships.

X-Ray Shows Symmetry of Sealed Chamber Valve

THE condition and symmetry of the sealed chamber of an aircraft valve no longer need be guessed with the application of the X-ray to a new inspection process now regular practice at Thompson Products, Inc., Cleveland.

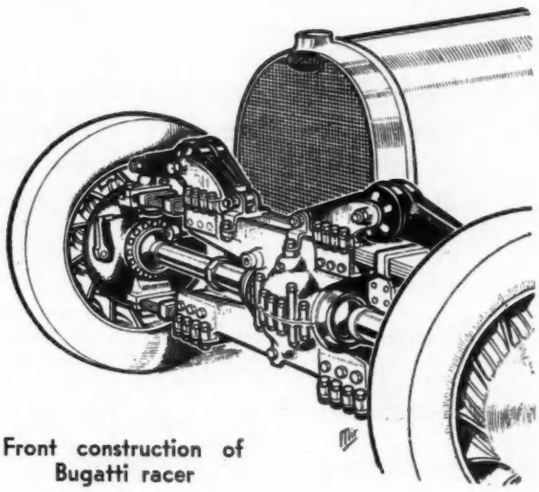
Thompson engineers recently developed a hollow valve without seams or weld. Chamber symmetry, wall thickness and steel condition were highly important to the successful operation of the valve. To accurately determine these elements the X-ray was applied to inspection.

Following a mechanical inspection after manufacture, the valves are X-rayed in multiple from two different angles. The plates are then developed in sets and placed in a stereoscope manufactured by the General Electric X-Ray Corp. Proper focus is obtained and each valve appears in phantom while an inspector carefully examines each image for chamber symmetry, foreign material in the cavity, flaws or defects in the steel.

Where the hollow head valve will tend to improve engine efficiency and performance, the new inspection process adds to reliability by revealing mechanical defects in valves which were formerly undetectable.

Four-Wheel-Drive Racing Car For Difficult Runs

With wheelbase of 98 in. and tread of 49 in., powered with a super-charged engine delivering 300 hp., the car is designed to give maximum traction for rapid acceleration



Front construction of Bugatti racer

ETTORE BUGATTI of Molsheim, Alsace, has recently developed a four-wheel-drive racing car which is expected to take part in some of the more important European racing events of the coming season. Bugatti has competed in the Targa Florio race in Sicily and the Alpine Cup race in recent years, both of which are carried out over very difficult routes where cars must be continually slowed up for taking sharp corners and then rapidly accelerated again. It is evident that in such races the four-wheel drive (the total-adherence principle, as the French call it) offers decided advantages. The following particulars of the Bugatti four-wheel-drive racer and the accompanying illustrations are taken from the *The Autocar*.

The car is equipped with an eight-cylinder in-line supercharged engine of 86 mm. bore and 107 mm. stroke (3.386 in. by 4.217 in.), giving a piston displacement of 295 cu. in. It is said to deliver 300 hp. The supercharger is of the Roots blower type and driven by bevel gears from a cross shaft. The wheelbase is 98 in. and the tread 49 in. In racing trim the car weighs 2075 lb.

Behind the engine, but connected to it by a universally jointed shaft, is a special gearbox, the housing of which extends right up to the chassis frame members, thus tending to stiffen the chassis. The gearbox contains three shafts (ignoring the reverse pinion shaft); the primary shaft, an intermediary shaft, and the driven shaft carrying a differential. Whatever the gear used, the power must go through the intermediary shaft, so that there is no direct drive. There are two sets of sliding pinions, one giving first and fourth speeds, and the other second and third. The reason for this arrangement is that for hill work second and third are the gears most frequently used, and quick changes from one to the other are essential.

From the ends of the differential shaft in the gearbox the power is carried forward by means of an open shaft alongside the engine to a pair of bevel gears in a front axle housing, and rearwards to what is practically a normal-type Bugatti rear axle housing.

The rear axle is a built-up type, with a vertically divided differential housing in aluminum and steel tubes. A truss-rod is used on the axle housing, and suspension is of the well-known Bugatti type, by quarter elliptics having their thick ends rearwards. A pressed-steel torque arm, with the usual elastic attachment at the front end, is made use of.

At the front everything is new. From the gear box the driveshaft is carried forward through the steel bulkhead, through the left-hand rear engine hanger, in which it has a steady bearing, and under the forward left-hand engine hanger. It has a metal universal joint connection to the bevel-pinion shaft.

The two chassis frame members are united at the front by a two-piece aluminum casting, each one consisting of a deep channel section rail and half of a differential housing. Two very broad transverse springs, each one having five leaves, are carried in the upper and lower channels of the aluminum cross-member. They are so well guided in the channels that there can be no horizontal movement and no torsion under braking and driving stresses such as occur in racing.

There are no stub axles, but the ends of the springs are attached, by means of ball and socket connections, to flanges on a cast-aluminum circular plate which fills the functions of the usual steering knuckle and has the main steering levers bolted to it. Double-arm friction-type shock absorbers, which also act as radius arms, are attached to this disk by means of ball and socket connections. The differential-driveshafts have a metal universal joint at each end. As in the case of other Bugatti cars, the wheel is a single aluminum casting, together with its brake drum, and has helical spokes to assist in cooling.

Because of the front-wheel drive the radiator has reduced height, and, in consequence, has been made much wider than that of other cars. The head resistance has been increased, but an attempt has been made to nullify this by means of a cowling in front of the radiator which encloses all the central portion of the springs, the frame cross-member, and the differential housing. This gives the car a blunt, bullet-shaped appearance when seen head on, with a very pronounced impression of power and speed.

The weight is carried equally on the two axles with petrol tank filled and in full racing trim. As the tank empties there is a slight excess of weight on the front axle.

Tomorrow's Truck

Truck and Bus Problems Ahead:

Demand for increased average speeds must be met. Differences in axle ratio and more cubic inches in engine will be part of the answer.

Ability factor of trucks and buses far behind the passenger car.

Constant pressure cycle engine offers attractive features, but present development is not promising.

Controls must be simplified.

Windage considerations increasingly important.

Independent springing.

Axles are becoming heavier—they should be lighter.

B. B. Bachman, vice-president and chief engineer of The Autocar Co., held the Metropolitan Section, S.A.E., spellbound on April 21 with his discussion of the trend of commercial vehicle design

WHAT future developments in truck and bus will be can be most successfully determined from what has happened. Automotive transportation created the demand for improved roads which, in turn, made desirable increased speed, made it possible to cover greater distances and made it necessary to provide more power, comfort and safety as features of design.

It seems logical that these trends will carry on in this same direction. Roads will be made wider, grades will be reduced, radii of curves increased, crossings at grade eliminated and in consequence higher speeds will be possible. As a result we note that consideration is being given to windage and the forms which will reduce it to a minimum and also provide stability. At the same time we must give thought to the need for simplification of control to increase the certainty of operation.

The passenger car has reflected these trends most rapidly, but the bus and truck have never been very far behind and, in some instances, have been the leaders. Unfortunately steps taken to simplify control have resulted, in the initial stages, in increased mechanical complication. This is evidenced by the term gadget, which has appeared in recent months. As I see it, out of the gadget will emerge eventually a coordinated mechanism, which will provide the desired simplicity of control and although the mechanism in its entirety may be more complicated, it will be less obvious. It is significant, however, that the objection of complexity apparently never operates to retard acceptance by the public of a device which produces a desirable result. The power plant is always a conspicuous and important automotive consideration. While there has been a notable improvement in the ability factor of trucks and buses in recent years, we are still far behind the passenger car. True it is undesirable to provide for maximum speeds on a comparative basis, but it is essential to provide for increased average speeds. This can be accomplished in part by differences in axle gear ratios, but this still leaves a gap that can only be filled by cubic inches in the engine.

Increasing displacement obviously introduces a large number of difficult problems. In the first place, if a high ability factory is provided for acceleration and hill climbing, there will be a very considerable part of the time when the engine will be operating at a low and uneconomical load factor. From this angle, the constant pressure type engine, if it is possible to approximate such a cycle in high and variable speed engines, offers attractive features. As matters stand at present, this solution does not seem very promising. While I appreciate the danger of making such a statement, I am nevertheless of the opinion that present developments of Diesel engines are not promising. This opinion is based upon such items as weight, cost, smoothness and low specific power output.

Secondly, the question arises as to how big displacement per cylinder can be used satisfactorily. Engines are being built today with displacements approaching 150 cu. in., but I believe that it is safe to say 125 cu. in. is a desirable maximum and 100 cu. in. far better. Many of the factors which prompt this statement are well known, but there is one that has not been stated so generally. I refer to the matter of speed, more particularly the speed produced when the engine is used as a brake. In a passenger car, maximum engine speed occurs in driving the car with wide open throttle and inertia effects of reciprocating elements are counterbalanced by pressures developed on the piston. In the truck and bus, limitations of power and provision of a governor inhibit these high driving speeds. The limitations of brakes, to which I will refer later, makes it necessary, however, to use the engine as a brake with the slower reductions of the transmission engaged and this frequently causes excessive speeds under most unfavorable conditions.

This gives rise to the conjecture as to whether it would not be possible to arrange to turn the engine

and Bus Design

This abstract of his paper gives the highlights of his daring projection of "tomorrow's problems" in a field which he is eminently able to speak about from his long experience in the automotive industry

into a compressor and thereby provide a most effective brake, with adequate means for dissipating the heat and at the same time, eliminate the destructive results of the present system.

Clutch and transmission system are, of course, fertile fields for speculation. The clash gear has had its full share of criticism, all justified logically, but strange to say, no definite improvement is in sight. The gas-electric system has had a considerable period of trial, but except for certain specific problems, has not received unqualified approval. Apparently no attempt by means of liquid or air as a transmission medium has progressed beyond the experimental stage. Use of multi-range transmissions is a step in the direction of greater number of gear changes toward the ideal of infinite change, which has been beneficial to a limited extent, but open to obvious criticism. On the whole, the picture seems to be one of negation. The ideals are simple and easily stated, but the means to attain them difficult.

Axles, both front and rear, are open to criticism on the ground of excessive weight and with increased service demands of greater speed and load, seem destined to grow heavier rather than lighter. The question of weight reduction seems to hinge upon the possibility of making bodies perform the function of carrying power units and of developing a satisfactory method of independent springing of the wheels. Solution of this problem presents many difficulties. On the bus, some progress has already been made in the direction of making the body the principal structural element of the chassis, but the truck seems to present greater difficulties. One of the most obvious is the fact that body forms and dimensions vary greatly, and it seems almost hopeless to effect sufficient compromise to develop a possible production design.

Functions of control afford another field where need for change seems desirable. Some details have already been touched on, but the subject merits more detailed treatment. With the greater loads and higher speeds and larger mileage covered per trip or per day, it is imperative that control of the vehicle be made as easy for the operator as possible. Large section, low pressure pneumatic tires have made steering a harder problem. Developments in steering gears have been satisfactory so far, but it is probable that heavier front wheel loads will be demanded which will require still further improvement in steering apparatus. This brings up the question of power steering. Considerable work has been done in this direction, but much more is needed before power steering can be considered acceptable. While present types give satisfactory results at slow speeds, control at operating speeds is uncertain and it would seem that graduation of power assistance in inverse relation to vehicle speed is a necessity.

Outside of mechanical limitations of the friction clutch and sliding gear transmission, which has been referred to, operation of this mechanism from a control standpoint leaves much to be desired. This is particularly true in city operation, both of buses and trucks. In the bus, the electric transmission system has had its greatest acceptance in this field, but there is still ample room for improvement. It is much easier to set up the ideal to be sought after than to outline means for realizing it.

The importance of braking needs no emphasis. It can probably be best analysed by separating consideration into two parts, operation and energy absorption. For heavy duty vehicles, air control is gradually being developed to a point that leaves little room for criticism. Elimination of mechanical connections, provision of means for operation of trailer brakes, equilization of pressure to the various brakes and ease of operation, are all most desirable features. On the other hand, while great improvements have been made in brakes mechanism, including drum material, friction facing, etc., there is still much to be done. In the first place, the conflict between the tire and brake to occupy the same space, continues with unabated fury, and if the extreme low pressure tires recently proposed

Something Else to Think About:

An all-rotary motion engine, high temperature gases and pressure not in contact with parts which cannot be provided with direct means of eliminating heat.

Operating temperature at most favorable point throughout operating range, same efficiency throughout range, and full torque from zero to maximum speed.

Power should be delivered to all wheels in direct relation to traction without use of mechanical universal joints or differentials.

Body and chassis should be incorporated into one structure.

for passenger cars can be accepted as an indication of what the future holds in store, the brake is out of luck. For short application in ordinary operating conditions, the present brake works satisfactorily, but there is no doubt that for control on down grades, the amount of energy that must be handled is too great for present mechanism or indeed for any conceivable mechanism of the present type that can be incorporated within the available space. It would seem that what is necessary is a design which will provide for the dissipation of heat as fast as it is generated as nearly as may be. One scheme of this sort has already been referred to.

The improvement in roads and the development of pneumatic tires has greatly improved the riding quality of all vehicles. Nevertheless, it would seem that a radical departure from present spring suspension might result in improvement in riding together with a lessening of weight, complexity and cost. I cannot tell you how this can be done and know of no present developments that are promising.

In the statements made so far, I have tried to keep within reasonable limits although I have no doubt that there are many points open to attack. Possibly, as some compensation, I may now be permitted to roam farther afield.

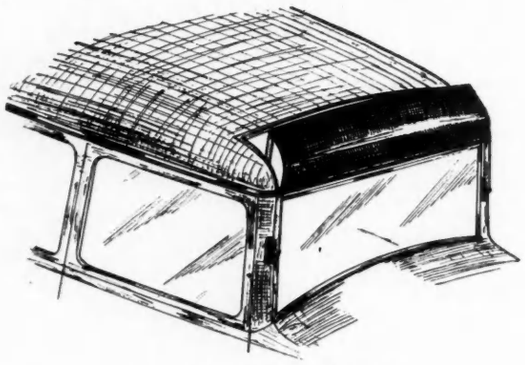
It may be interesting to set up some ideals which seem as remote as some of the outposts of the universe.

Starting on this journey, by taking the power plant, what we want is an engine in which the mechanical motions are all rotary; in which gases at relatively high temperatures and pressure do not come in contact with parts of the mechanism, which cannot be provided with direct means of eliminating heat, in which the operating temperature can be maintained at the most favorable point throughout the operating range of speed and load and which will have the same efficiency both mechanical and thermal over this same range. It should also be possible to exert full torque over the speed range from zero to maximum. The power from the engine should be delivered to all of the wheels in direct relation to the traction they have without the use of mechanical universal joints or differentials. The body and chassis should be incorporated in one structure so that advantage could be taken of the stiffness it is possible to develop in a structure of this form. The wheels should be independently sprung to the structure by means of a system which would automatically adjust itself to all conditions of load, speed and road. The control should consist only of a means of steering to be operated by hand and one pedal lever for starting and varying the speed and one for controlling brakes.

Green Visor-Ventilator

A SPECIAL visor-ventilator adapted to the modern roll-front (or what is known as the eddy-free front in England) of automobile bodies has been developed by Hugh Green, an automobile engineer of Coventry, England. The construction is shown by the drawing reproduced herewith.

The ventilator, of course, can be completely closed, and its forward and rear edges can be moved independently. In wet weather, for instance, the ventilator can be swung open around its forward edge, so that it



Green visor-ventilator

stands practically vertical, and it is claimed that no rain can then enter the body if the car is in motion. If the visor is moved all the way forward it is said to act as an efficient sun visor and also as a miniature sliding roof.

Mr. Green makes the following claims for the visor-ventilator:

1. Constitutes an ideal ventilator-extractor in wet weather.
2. Acts as a visor.
3. Affords many of the benefits of the sliding roof and enables one to view the scenery and high buildings.
4. Can be set in any position to counteract the glare of a rising or setting sun.

A.W.S. Meeting in New York

(Continued from page 689)

The symposium on ductility drew a many-sided discussion from the following imposing group of experts:

C. A. Adams, Harvard University.
E. Chapman, Lukenweld, Inc.
E. R. Fish, Hartford Steam Boiler Insp. & Ins. Co.
C. J. Holslag, Electric Arc Cutting & Welding Co.
C. H. Jennings, Westinghouse Electric & Mfg. Co.
H. F. Moore, University of Illinois.
D. Rosenthal, University of Brussels.
C. L. Waddell, Worthington Pump & Machinery Corp.

Space does not permit much more than passing comment but it would pay those interested to study these papers carefully. They will get you posted on the latest thought on this subject. Automotive men casting about for new applications of welding such as chassis frames, for example, may get a lot of help from the excellent work that has been done in the design of welded joints, methods of testing and suggested procedure.

In this connection, Everett Chapman of Lukenweld is doing some valuable work. He has worked out a special photoelastic technique by means of which it is a relatively simple matter to evaluate design for welding. His analysis brings out the regions of maximum stress concentration and permits the engineer to change things around so as to eliminate the objectionable conditions. Mr. Chapman has been very successful in building welded frames for machine tools, presses, and heavy-duty Diesel engine parts.

Prof. H. F. Moore coins a new term, "crackless plasticity" in seeking a criterion for ductility. A joint or section possessing this property would be free of the tendency to spreading of cracks under high stress.

Photo courtesy Monarch Machine Tool Co.

PRODUCTION LINES

Coming Along

Molybdenum as an alloying material seems to have boundless possibilities. In automotive alloy steels it permits higher tempering temperatures for a given hardness and produces depth - hardening on quenching large pieces. It is also said to increase wear resistance by combining toughness with great hardness. For cast irons its specific effect is to increase resistance to creep at high temperatures. A scholarly study of molybdenum, its status and future is found in *Metals and Alloys* for April, 1932. By J. L. Gregg and H. W. Gillett of the Battelle Memorial Institute.

Going All Steel

Commerce Reports for March 21, 1932, carries an interesting news item concerning the Steyr (Austria) automobile. To us the most interesting thing is the fact that the car has an all-steel body. It is made in four sections, electrically welded.

Color Guide

A simplified method of color mixing and matching for the automotive paint and trim shop is offered by the ArcoZon. This device is made by the Arco Co. Color chips and formulas are provided for every make of automobile.

We Like It

Short time ago we commented on the trend of industrial art—the striking effects of artistic photography in picturing machines and mechanical processes. Those of you who like this sort of thing will get loads of pleasure out of a new booklet describing Monarch lathes. It has a cover of hammered copper that'll hold you when you take it out of the wrapper. The fotos are swell. Ask for bulletin 164.

Under Control

Another fine piece of business literature has come from the Policyholders Bureau of the Metropolitan Life Ins. Co. This one is on "Materials Control." It is a sort of quick survey of methods used by many successful manufacturers. Something in it may help you despite the generalized character of the presentation.

Why Pay More?

Understand that a mid-western concern has worked out a way of producing fairly complicated stampings without the use of permanent tools. They claim to be able to make parts for you from blue prints in short order—no delays for tooling, no heavy tool expense. If it works as they say, you could swing into production on lots as small as 100 pieces and get the job done for the price of a hand-made sample.

Circuit Protection

A safe, flashless circuit breaker for plants and buildings is now made by Westinghouse. This "De-Ion" breaker replaces fused knife switches, safety switches, etc. It takes only about 70 per cent as much space as the usual breaker and is said to open a short circuit without flash or appreciable noise.

Blow Hot-Cold Out

By a series of tests over a long period, Chrysler Motors engineers have perfected the insulation of Chrysler all-steel bodies to the extent that sound, heat and cold are nearly eliminated. The entire body is lined with jute felt almost an inch in thickness.

Tensions at Chrysler

To insure smoothly operating valves that open and close with perfect uniformity, valve springs used in the Chrysler Six and Eight are graded in five classifications, according to tension. By having all the springs in an engine of like tension, there is little variation in the functioning of the valves.

SOS

Several issues back we had a Production Lines page that drew many inquiries. More than usual in fact. We'd like to keep it up—by giving P.L. readers the kind of stuff that helps in their work. May we have some volunteers out of the bunch that read this page. Send in your suggestions. They'll be appreciated.

Standards Here and There

A bibliography on standardization has just been published by the U. S. Dept. of Commerce. Contemporary literature of all countries in the field of management, economics, business, etc. Bureau of Standards Miscel. Pub. No. 136.—J.G.

MANUFACTURING MANAGEMENT METALLURGY

Pratt & Whitney Adapts Fuel-Injection to Hornet Engine in Regular Mail Run

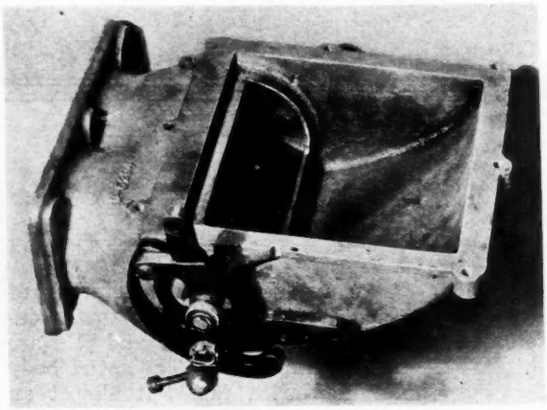


Fig. 1—Form of air throttle employed with fuel injection system

FOLLOWING are some details of the Pratt & Whitney direct fuel-injection system as installed in a Hornet engine that was put into flight tests recently on a Boeing mail plane in service on the Boeing division of United Air Lines.

The carburetor and hot-spot are replaced by a throttle valve which is bolted directly to the flange of the carburetor elbow on the rear crankcase section. The body of the throttle valve is an aluminum casting.

The fuel injection pumps are carried in a casting which replaces the standard front section of the crankcase. They are arranged radially, immediately in front of the valve-tappet guides. The pump-actuating mechanism comprises a four-lobed cam carried on the forward face of the valve-operating cam, the whole assembly being carried on an extension of the crankshaft thrust-bearing retainer.

Fuel injection "hammers" are carried in guides in the crankcase front section. They are provided with springs which seat against the cam-bearing support. A stop cam having nine lobes, one for each hammer, is arranged concentrically around the hammers and limits their movement, for the purpose of controlling the length of stroke of the injection pumps. Angular motion is imparted to this control cam by a rack and pinion connected to a linkage on the outside of the crankcase, which in turn is connected to the air valve on the rear section.

The injection pumps are mounted in line with the injection hammers and approximately on the center line of each cylinder. They are made of duralumin forgings which form the body, and a pump plunger with packings suitable for gasoline. At the inner end of each pump plunger there is a flange which engages into a slot in the injection hammer.

Injection nozzles are located in front of the cylinder heads immediately above the spark plugs; they are connected to the pumps by steel tubes of uniform length.

The fuel supply system consists of a standard fuel pump as used with carburetors. This pump delivers fuel at the lowest point of a circular steel manifold which is securely fastened directly to a connection on each of the nine fuel pump cylinders. A suitable screen is provided around the inlet port to each pump cylinder. This manifold is specially designed to carry off any trapped air which may find its way in with the fuel. The excess fuel supplied by the main fuel feed pump, together with any trapped air, is carried off through a pressure-relief valve at the top of the manifold, and is returned directly to the main fuel supply tank.

The method of operation of the injection pumps is as follows: The fuel-pump hammers are provided with shoes which engage four lobes of the pump-operating cam. These cams draw the hammers inward toward the crankshaft. The cams are so arranged that the hammers are drawn back slowly, in order to permit flow of fuel into the pump cylinders at a normal slow rate. Their contour is such that they overrun a sharp edge on the shoe, permitting the springs (which have been compressed by the inward movement of the hammers) to return the hammers with a rapid movement.

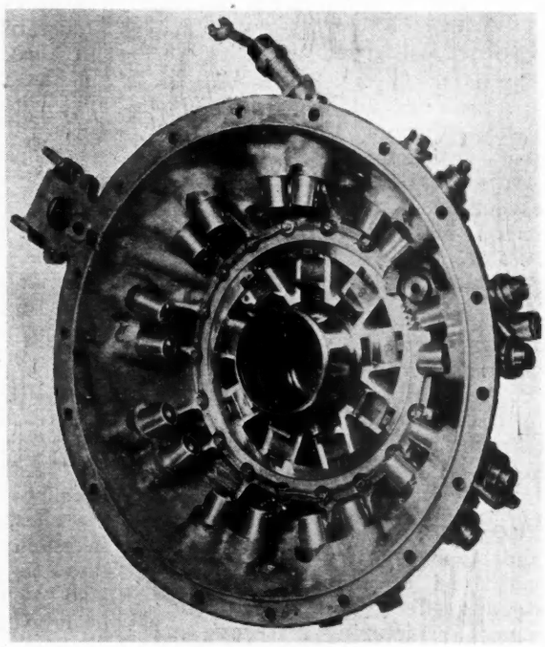


Fig. 2—Interior view of nose section of engine, showing mechanism for operating the injection pumps

Clearance is provided between the heads of the hammers and the heads of the injection pistons and arranged in such a manner that a sharp hammer blow is imparted to the piston, assisting in the atomization of the fuel. The pressure of fuel discharge can be regulated by the adjustment of the springs which control the hammers and injection valves. The hammers are restrained from their outward movement by the nine-lobe cam previously referred to, operated by the rack and pinion, which in turn is interlinked with the throttle valve. The adjustment on this control cam is sufficient to completely cut off the pump stroke if desired, and on the opposite end of the travel provides sufficient stroke for full throttle operation.

The pilot's controls are similar to the standard controls and designed to mount interchangeably in place of the standard control quadrant. They consist of a lever which is connected to the linkage on the air valve controlling the injection-pump stroke and metering of air with the one lever. The usual mixture control lever is replaced with a similar one which varies the setting of the pump stroke with respect to the air valve and does not interfere with the free movement of the main control lever. A third lever is connected in the usual manner to the magneto breaker.

Experimental engines with the fuel system described have gone through several hundred hours of operation on the test stand and in the air. Department of Commerce tests have been successfully passed. It is stated that while most of the development work so far has been based on the use of gasoline as fuel, with certain modifications in the fuel system and the cylinders it is possible to use heavier fuels, and that an engine already has been flown on furnace oil.

Forming Operations on Spoksteel Wheel

THE amazing diversity of production activity that goes on in every corner of this gigantic automotive industry is exemplified by the following description of the way the Motor Wheel Corporation makes the wheel spider for the well-known Spoksteel wheel for motor trucks. The spider begins life as a billet which is hammered into a partially finished form as shown in Fig. 1; the finished wheel as we see it on the truck is found in Fig. 2.

In the first operation the billet is upset endwise. This is the first step in producing a radial grain structure so desirable in the finished part. At the end of the first operation the material is in a partially finished form and ready for the several other steps which convert it into a spider. In brief, the routine operations are as follows:

Fig. 1—The wheel spider begins life as a billet which is hammered into a partially finished forging

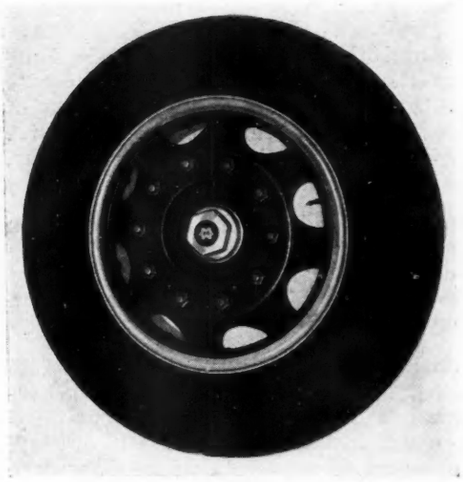
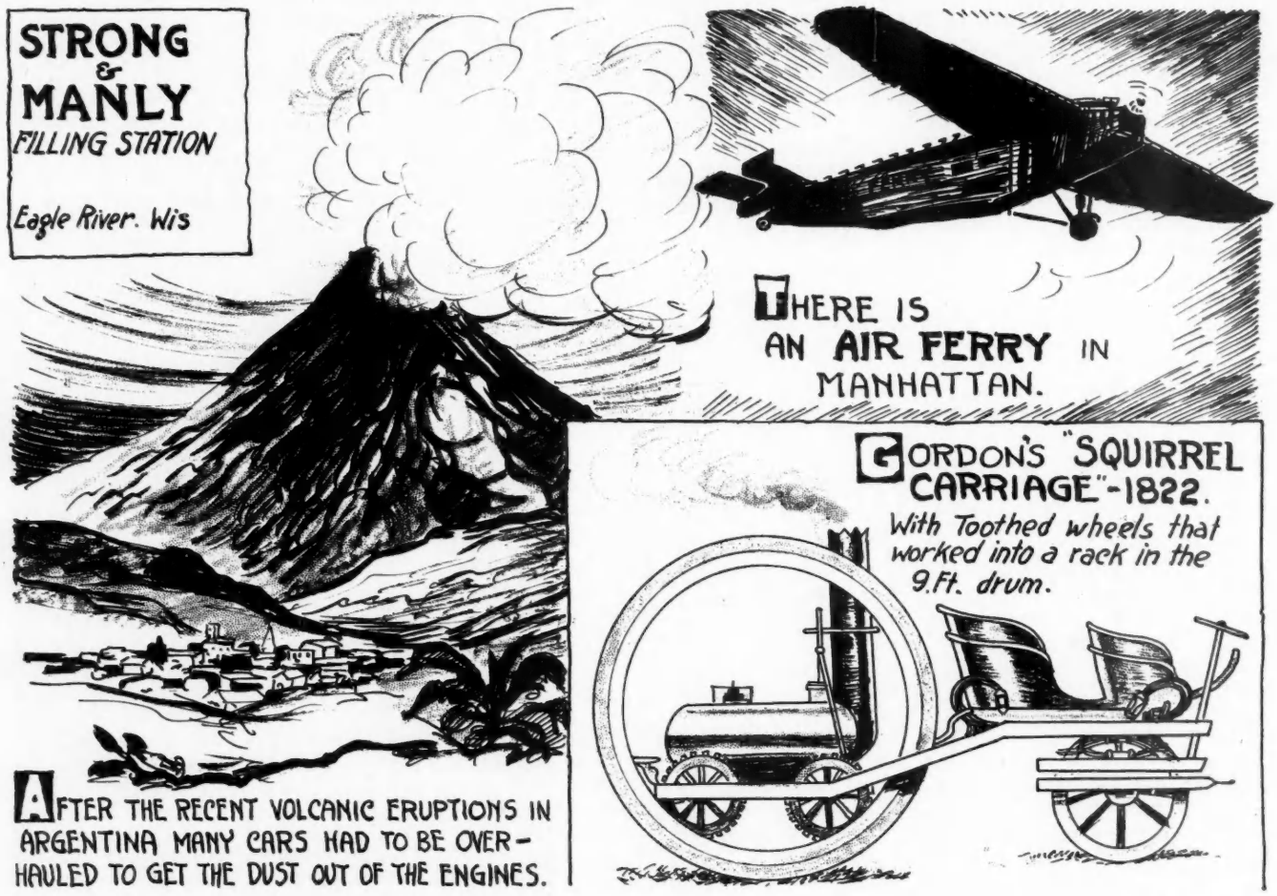


Fig. 2 — The complete Spoksteel wheel with tire mounted

1. Upsetting.
2. Completing the forging operation. The partially finished forging is hammered into a disk ready for the forming and piercing.
3. Blanking and piercing, rough.
4. After rough-forming, bolt holes and the center bore are drilled accurately in a special fixture.
5. The spider now undergoes the finish-forming and flanging.
6. After the rim is riveted to the spider, the bolt holes and the center bore are finish-reamed.
7. Fig. 2 shows the complete Spoksteel wheel with tire mounted ready for the road.

Perhaps the most interesting feature of the whole setup is the use of modern equipment and well-designed tools and fixtures which contribute so much to accuracy and favorable manufacturing costs.

Automotive Oddities—By Pete Keenan


STRONG & MANLY
FILLING STATION
Eagle River. Wis
THERE IS AN AIR FERRY IN MANHATTAN.
GORDON'S "SQUIRREL CARRIAGE"-1822.
With Toothed wheels that worked into a rack in the 9.Ft. drum.
AFTER THE RECENT VOLCANIC ERUPTIONS IN ARGENTINA MANY CARS HAD TO BE OVER-HAULED TO GET THE DUST OUT OF THE ENGINES.

Write us if you know an "Oddity"

The News Trailer

Rum-running automobiles may be forfeited under either the prohibition or customs laws, the Supreme Court ruled in a series of test cases brought by two automobile finance companies. The decision was read by Justice Benjamin Cardozo.

Both appeals were caused by a recent ruling that vehicles carrying liquor on which the tax had not been paid could only be forfeited under the dry laws and not under the revenue laws.

The automobiles involved were seized at the Mexican border in California and Texas after customs agents had allowed them to enter the country before seizing them.

New York legislators will be asked to pass a law to license three automobiles. These three cars run on privately built highways of Ocean Beach, on Fire Island, off Bay Shore, L. I. An automobile accident disclosed the fact that no licenses have ever been issued and no driver's license is required.

A tin cartel is at work. Spectacular failures in tea and rubber cartels have not discouraged tin producers in the Malay Archipelago and other nearby tin-producing states. Production will halt in two months, cartel managers say.

Taxes, excise and others, will be dealt with in *Automotive Industries* next week. If we had the space we would like to print a "vote-by-vote" account of the shifting to, from and again to the automotive excise tax. It would sound like a juggler's ecstasy. The issue is wildly alive.

Airplane passenger and freight service between Toronto and New York soon will be inaugurated by a Canadian company. Both amphibian and land planes will be used in the journey, which is said to require from 3½ to 4 hr.

Eurasia Aviation Corp. (German) is planning to inaugurate a regular airline service between Berlin and Shanghai, a distance of virtually one-third of the way around the earth, before the end of May, according to a report from the American Consulate at Berlin, made public by the Commerce Department. Special Junkers planes have been built for this purpose.

NEWS

Motor Tax Fight is Due in Senate

Couzens Expected to Head Battle Against 3-2-1 Excise Tax on Floor

WASHINGTON, May 2—As he lost his first skirmish last week to have the automotive excise tax taken off the Senate bill now in Finance Committee, Senator James Couzens indicated today that the fight "is on."

Both he and his colleague, Senator Arthur H. Vandenberg of Grand Rapids, are expected by the industry to lead the battle against "discriminatory taxes" when the measure finally leaves the Finance Committee of the upper house and comes to the Senate floor.

The move made last week by Senator Couzens was voted upon by the powerful committee and was lost, 5 to 12. He asked that the schedule of 3 per cent tax on automobiles, 2 per cent on motor trucks and 1 per cent on parts and accessories be eliminated from the committee's recommendations.

The motor excise tax, estimated to yield from $42,000,000 to $56,000,000 in new revenue for 1933, has been the subject of congressional hearings and legislative debates for almost a year.

The administration, through Secretary of the Treasury Ogden L. Mills and his predecessor Andrew W. Mellon, has recommended a 5, 3 and 2 per cent excise tax schedule for the automotive industry. This tax would be economical to collect as proved by the previous experience of the high excise tax on the industry during the reconstruction period following the World War.

Other proposed taxes discriminating against the automotive industry are the 8 per cent levy on gasoline transported in pipe lines, a tax of ¾ cent per gal. on gasoline and a 2-cent tax on motor lubricating oil.

U. S. Tire On Five-day Week

DETROIT, May 2—Beginning today, the tire department of the United States Rubber Co. increased operations to five days a week, with three eight-hour shifts a day. The department had been working an average of four days a week.

The May production schedule calls for a 15 per cent increase in tires, according to J. F. O'Shaughnessy, general manager of the tire department. This increased schedule will mean more hours of work for the employees now on the payroll, and will necessitate the recall of a few former employees.

Based on orders now coming in from both car manufacturers and tire dealers, it is estimated that June output will surpass that of May by another 15 per cent. Approximately 3000 men are now employed.

Annual Automotive Excise Tax If Production Equals 1931 $42,210,625

Passenger Cars		
Production for U. S. market	1,839,042	
Wholesale value	$1,057,449,150	
Average wholesale value per unit	$575	
Excise tax @ 3%, per unit tax	$17.25	
Passenger car tax		$31,723,475
Motor Trucks		
Production for U. S. Market	309,139	
Wholesale value	$191,358,041	
Average wholesale value per unit	$619	
Excise tax @ 2%, per unit tax	$12.38	
Truck tax		$3,827,160
Parts—Tires—Accessories		
Wholesale value for replacements	$666,000,000	
Excise tax @ 1%		
Total on parts		$6,660,000
Tax on cars, trucks, parts		$42,210,635

How Senators Voted on Tax

The motion of Senator James Couzens, Mich., to strike out the motor excise taxes was voted down 12 to 6, April 28. Originally it was reported that the vote was 12 to 5. The vote follows:

Against the motion: Senators Shortridge, California; LaFollette, Wisconsin; Metcalf, Rhode Island; Harrison, Mississippi; King, Utah; George, Georgia; Walsh, Massachusetts; Connolly, Texas; Gore, Oklahoma; Hull, Tennessee; Smoot (chairman), Utah.

Those voting for the motion were: Senators Couzens, Watson (majority leader), Indiana; Reed, Pennsylvania; Keyes, New Hampshire; Bingham, Connecticut; Thomas, Oklahoma.

G.M. Dividend Cut to 25 Cents

Previous Annual Rate of $2 Reduced to $1 to Keep Finances Strong

NEW YORK, May 4—Directors of General Motors Corp. at their meeting today declared on the outstanding common stock a quarterly dividend of 25 cents a share, payable June 13, 1932, to stockholders of record May 14, 1932.

Three months ago, a quarterly dividend of 50 cents was declared, which was a reduction from the 75-cent quarterly dividend which had been paid since the beginning of 1930.

In addition the regular quarterly dividend of $1.25 a share was declared on the $5 preferred stock, payable Aug. 1, to stockholders of record July 5.

Mr. Alfred P. Sloan, Jr., president, with respect to this action, said:

"At their meeting today the directors felt that a reduction in the common dividend rate from 50 cents to 25 cents equivalent to a change in the annual rate from $2.00 to $1.00, was in keeping with the fact that, due to the downward trend in business, the corporation's earnings have not met expectations and was in harmony with the corporation's policy of maintaining its present strong financial position."

Net profits of General Motors in the quarter ended March 31 were equal to 17 cents a share on the 43,500,000 common shares, compared with net profits equal to 61 cents a share in the first quarter of 1931. Cash and marketable securities at the end of

(Turn to page 700, please)

Qualifying Run for Indianapolis 500-Mile Grind Upped to 100 m.p.h.

Forty-seven Entrants to Date Make Committee Confident That Event Will Be Fastest in History

INDIANAPOLIS IND., May 4—More than 67 entries have caused officials to raise a barrier to a 100 m.p.h. speed as the minimum requirement for cars to start in the International 500-mile race here on May 30.

Entries must complete a 10-mile run, four times around the two-and-a-half mile brick track, at an average of at least 100 miles per hour to qualify.

Each contestant has three opportunities to make the grade but once they establish their qualifying mark, it stands. The fastest qualifier, of course, gets the coveted pole position, number one car, first row on the inside.

This will be first test, 10 m.p.h. faster than the requirements of previous years, in an attempt to cull the prospective contenders down to the 40 starting cars.

Boosting the initial qualifying runs promises that track records will be shattered this year.

Experts believe that the slowest qualifier of the forty cars will run at least 105 m.p.h. and that the car grabbing the pole position will boost its speed up between 117 and 119 m.p.h.

For six years the 101.13 m.p.h. record average set by Pete De Paolo in 1925 for the 500-mile grind has stood. Two years ago it nearly fell when Billy Arnold averaged 100.448 m.p.h. in winning. Last year a rain-soaked track caused several official slowdowns.

The boys have been whooping it up on board and dirt tracks throughout the summer, driving better mounts faster than ever. Three times during the year the mile record has been broken. Now, with the knowledge that they must drive faster to qualify, it seems certain that a new record will be hung up May 30.

Autocar 1½ Tonner Replaces Model A

Latter Redesigned As 2-Ton with 5 speeds

The Autocar Co., Ardmore, Pa., has brought out a new 1½-ton truck, its Model R, to take the place of the former Model A, which latter has been redesigned to permit of a 1½-2-ton rating. Among the changes made in the latter model are the provision of a 5-speed transmission, a heavier frame with side rails 8 by 3 by ¼ in. section, a Handy governor, a heavier Timken front axle and a G & O radiator. The price remains $3,200.

Model R, the new 1½-tonner, lists at $2,250 and is offered in three standard wheelbases of 159, 171 and 180 in. The engine is an Autocar six-cylinder of 3¾ x 4¾ in., developing 75 hp. at 2400 r.p.m. It is mounted in unit with a Long clutch and a 4-speed Brown-Lipe transmission.

The rear axle is of Autocar make and has spiral bevel-gear drive. It has a standard reduction ratio of 5.22, but a ratio of 6.12 is optional. Service brakes are four-wheel hydraulic, while a parking brake of the contracting type acts on a drum back of the transmission.

General Motors Halves Dividend

(Continued from page 699)

March totaled $186,700,000 compared with $179,000,000 a year previous, while working capital on March 31 last, was $271,500,000 against $292,700,000 at the same date in 1931.

Dividends declared on General Motors Common stock since 1924:

	Annual rate	*Quarterly rate*
1924	$ 2.15	(3 div. @ $0.30, div. @ $1.25.)
1925	12.00	(4 div. @ $1.50, plus $6.00 cash divs.)
1926	15.00	(4 div. @ $1.75, plus $8.00 cash divs.)
1927	11.75	(4 div. @ $1.75, plus $4.75 cash divs.)
1928	9.50	(4 div. @ $1.25, plus $4.50 cash divs.)
1929	3.60	(4 div. @ $0.75, plus $0.60 cash divs.)
1930	3.00	(4 div. @ $0.75.)
1931	2.75	(3 div. @ $0.75, 1 @ $0.50.)

Chevrolet Gains

DETROIT, May 2—Chevrolet dealers have reported retail sales of 19,672 new and 35,322 used cars in the second ten day period of April, according to H. J. Klingler, vice-president and general sales manager.

This is a gain of more than 2000 new and 9000 used cars over the first ten day period and is the best ten day total since last August, Mr. Klingler said.

In the second reporting period of April dealer stocks of used cars were reduced by 2320 units. Since March 1, when an intensive used car campaign was opened by Chevrolet, dealers reported the retail sales of 147,000 used cars up to April 20.

Sales of new cars in the first two periods of April were over 38,000 units.

Continental-DeVaux Reduces Price on "80"

DETROIT May 4—Price reductions ranging from $50 to $100 have been announced by Continental-DeVaux on its Series 80 models. The base price is now $725, or $75 lower. Prices follow: Standard coupe, $725; sport coupe and standard sedan, $775 (down $70); custom coupe and sedan, $845 (down $50); convertible coupe roadster, $895 (down $100). May production schedules call for 1200 units.

Schwarz Licenses Hunt

NEW YORK, May 4—The Fuel Oil Motors Corp. has licensed C. W. Hunt Co., West New Brighton, Staten Island, for converting marine gasoline engines to the Schwarz cycle.

The cycle is the invention of Alfred Schwarz and injects air under compression into the combustion chamber through compressing action of a sleeved piston acting in an annular chamber surrounding the cylinder. Either gasoline or fuel oil may be used in converted gasoline engines. The company claims economy running from 30 to 75 per cent.

Continental Buys Divco

DETROIT, May 5—Continental Motor Co. has purchased the assets and business of the Divco Detroit Corp., organizing Continental-Divco, a wholly-owned subsidiary, to continue the manufacture of trucks. Directors of the new company are W. R. Angell, Roger Sherman, F. F. Beall, Wallace Zwiener, John Nicol and Craig Keith.

Rockne Shows 140 Per Cent Gain

DETROIT, May 3—Rockne retail deliveries for the first 20 days in April showed a gain of 140.4 per cent over retail deliveries for the first 20 days in March, according to announcement by George M. Graham, vice-president of Rockne Motors Corp.

"Present indications are that the last ten-day period in April will show even further gains, while the outlook for May is very bright," Graham said.

Hupp Production Down

DETROIT, May 3—Hupp Motor Car Corp. has reported April production of 1293 cars against 2622 in March and approximately 3000 in April a year ago.

Graham-Paige Builds 1143

DETROIT, May 3—Graham-Paige Motors Corp. has reported production of 1143 units during April, compared with a total of 2105 during March.

Curtiss to Operate Plant in Turkey

U. S. Firm Signs Contract to Manufacture Engines in Anatolia

NEW YORK, May 4—In connection with the recent announcement that the Curtiss Aeroplane and Motor Co. had signed a contract under which it would manufacture its products in Turkey, it is now learned that Curtiss will take over the works which were erected in 1927 at Kaisserije, Anatolia, by the Turkish "Tomtasch" company in cooperation with the German Junkers Works.

The Tomtasch company went into bankruptcy in 1929, before manufacturing operations had really begun. Curtiss, it is learned, will enlarge and reequip this plant, and will manufacture in it not only planes of its own design, but also aircraft of other types, under license, to the order of the Turkish Government.

According to the contract, the equipment and operation of the factory will be carried on by American engineers and mechanics, but the personnel is to be gradually replaced and in the course of five years the factory is to pass completely under Turkish control. In addition to airplanes, several types of airplane engines are to be manufactured at Kaisserije, and the Curtiss company also has engaged to develop the raw materials and parts industries in Turkey.

Development of a national flying service was started upon immediately after the signing of the contract. An American specialist in ground installations undertook a number of prospecting flights to determine the best locations for airports and emergency landing fields. Since Turkey already possesses a considerable trained personnel, who at present are employed by operating companies in other countries, it is stipulated that both the flying and the ground forces are to be made up of Turks to the extent of 50 per cent from the start.

We understand that the Curtiss company secured the contract in the face of very active competition, particularly from German companies. After the collapse of the Tomtasch in 1929, offers to take over the plant were made by the Heinkel, Junkers and Dornier Works, and only recently a representative of the German Luft Hansa went to Turkey in the matter.

Fuhrman Twin-Axle Trailer

A new twin-axle for semi-trailers, due to the Fuhrman Trailer Co. of Canton, Ohio, has two short axles (31 in. long), one on each side, instead of a single axle. Each axle carries two semi-elliptic springs, one above the other, whose ends, instead of being shackled and pin-jointed in the usual way, are made to bear against wearing surfaces in two brackets secured to the under side of the frame side rails. Radius rods, which may be pivoted to either the front or the rear bracket, hold the axle in position both longitudinally and laterally. The axle is held in a spring chair which is secured to the two springs by U-bolts. There is one wheel on each end of each axle and therefore on each side of each pair of springs.

Licensed Pilots Show Small Drop

WASHINGTON, May 3—There were 17,628 pilots and 7476 aircraft holding active Department of Commerce licenses on April 1, 1932. In making this announcement Col. Clarence M. Young, assistant secretary of commerce for aeronautics, said there had been a slight decrease in these licenses since Jan. 1, 1932, when there were 17,739 licensed pilots and 7553 licensed aircraft.

The total number of aircraft, licensed and unlicensed, of which the branch had record on April 1, was 10,672, as compared with 10,780 on Jan. 1, 1932. Unlicensed craft (bearing identification numbers only) numbered 3196 on the first of April, as against 3227 on the first of January.

Leading the states in number of aircraft, licensed and unlicensed, was New York with 1203. California was second with 1193 and Illinois third with 719. Considering licensed aircraft only, California led with 968; New York followed with 951 and Illinois was third with 501. The greatest number of unlicensed aircraft was in New York, where there were 252, while California had the next greatest number, 225, and Illinois was third with 218.

In number of licensed pilots, California led with 3380; New York was second with 1787 and Illinois third with 1097.

Reo Production Up for April

DETROIT, May 2—Reo Motor Car Co. has reported production of 1204 units during April, a gain of 28 per cent over the corresponding month last year when production totaled 940 units.

L. A. Young Reports Net

DETROIT, May 3 — L. A. Young Spring and Wire Corp. has reported net income of $5,773 after depreciation, Federal taxes and charges, for quarter ended March 31, 1932, against a net income of $233,080 in the first quarter last year.

White Security Declares

CLEVELAND, OHIO, May 4—Directors of The White Motor Securities Co. in meeting declared the regular quarterly dividend of $1.75, payable June 30, to stock of record June 13.

State Officials Plan Conference

Administrators Ask Study of Safety in Car Designing

WASHINGTON, May 5—The Eastern Conference of Motor Vehicle Administrators, representing 14 states, the District of Columbia, and two Canadian provinces, plans a meeting here today of more than usual importance to the automotive industries. Benjamin G. Eynon, commissioner of motor vehicles for the Commonwealth of Pennsylvania and a leading member of the conference, expects to introduce the following resolution:

Whereas, The problem of highway traffic accidents is increasingly serious and should have the united attention of all interested agencies, and

Whereas, The Eastern Conference of Motor Vehicle Administrators is organized for the purpose of attaining uniformity of action between the member states on matters pertaining to legislation and administration of motor vehicle laws, and

Whereas, This conference has always been effective in such movements, especially as they relate to reciprocal relations between the states:

Therefore Be It Resolved, That the president of the Eastern Conference of Motor Vehicle Administrators immediately appoint a committee of six members of the conference to meet with the representatives of motor vehicle manufacturers for the purpose of studying the relationship between automobile construction and accidents; to further more complete cooperation between motor vehicle manufacturers and the states; to assure reasonably safe motor vehicles on our streets and highways from the standpoint of essential safety factors; to study the effects of new developments, and to consider the entire question of the motor vehicle industry's responsibility in reducing accident hazards.

George R. Wellington of the motor vehicle department, State Board of Public Roads of Rhode Island, is president of the Eastern Conference. Harold G. Hoffman, motor vehicle commissioner of New Jersey, is secretary. On the eve of the conference it was indicated that the Central Conference of Motor Vehicle Administrators, representing about 14 states, would have members present at the Eastern Conference.

Reo Reports Loss

DETROIT, May 2—Reo Motor Car Co. and subsidiaries has reported net loss of $753,277 after all charges and depreciation for quarter ended March 31, 1932, compared with a net loss of $420,832 in the first quarter last year and net loss of $175,437 for the first quarter 1930.

Indiana Motors Revises Truck Line With Fast, Light Delivery Models

White Sales Program, Embracing Arrangement With Indiana, Strengthened by Additional Series

Indiana Motors Corp., which recently entered into a sales agreement with the White Co., has rearranged its line and is now offering a number of models not listed previously. Models 85 and 85DR, which differ from each other only in that the former has a bevel-gear and the latter a double-reduction rear axle, are essentially oversize 1½-ton trucks, the former having a gross rating of 10,000 lb. They are designed for fast delivery in different lines of business and are furnished in five lengths of wheelbase, viz., 132, 141, 155, 169 and 186 in., the second being the standard ratio, and the last 3 carrying an extra charge. The engine is a six-cylinder Hercules of 3⅝ in. bore by 4½-in. stroke (263 cu. in.) and is rated at 68 hp. Model 85 has a four-speed Brown-Lipe transmission, a Timken full-floating, bevel gear-driven rear axle with 5.66 ratio, hydraulic brakes, and 6.50/20 balloon tires. Model 85DR, with a gross-weight rating of 11,500 lb., has the same major specifications as Model 85 but differs from it in having a five-speed transmission, a double-reduction rear axle, helper springs, and larger brakes (316 sq. in. of braking area instead of 249). Prices on the 85 models start at $885 and those on the 85DR at $1,190.

Another series announced at the same time, the 95, comprises four models, two being two-wheel drive four-wheel trucks, one a two-wheel drive six-wheel truck, and the fourth a four-wheel drive six-wheel truck. Capacities of these models range between 12,000 and 20,000 lb. Except for rear axles, brakes, frames, springs and tires, the major specifications of all four models are the same. The engine is a 3¾ x 4½-in. Hercules Six, developing 90 hp. at 2500 r.p.m. It is mounted in unit with a Brown-Lipe four-speed transmission. A five-speed Brown-Lipe is available at extra cost. Gasoline is fed by a Stewart mechanical pump from a 16-gal. tank under the driver's seat, to a Zenith carburetor equipped with a United air cleaner. Ignition is by battery.

Models 95 and 95DR, the four-wheel jobs, differ from each other in axle type and tire size. They are offered in five wheelbases, 141-in. standard, and 132, 155, 169 and 186 in. optional. The frames of these two models have maximum channel section of 7 7/16 x 2½ x 7/32-in. Springs are semi-elliptics, 37 x 2¼ in., in front and 54 x 2½ in., in rear. Service brakes are four-wheel hydraulic, expanding in 16-in. gun-iron drums, while the parking brakes are of external type and act on the transmission.

Model 95, priced at $1,095 and rated at 12,000 lb. gross weight, is fitted with a Timken single-reduction spiral-bevel, full-floating rear axle, with a standard gear ratio of 5.83 and optional ratios of 6.60 and 4.86. Standard tire equipment is 32 x 6, eight-ply, single front and dual rear. Model 95DR, with a gross rating of 15,000 lb., is equipped with a Wisconsin double reduction rear axle, having a standard reduction of 6.66. Optional ratios of 5.54, 6.06, 7.36 and 8.17 are available. Balloon tires, 7.50/20, single front dual rear, are standard.

The other two models of the 95 series are six-wheelers. Model 95SW75 is equipped with a Timken tandem worm drive, and Model 95SBT150 with a Timken tandem unit with spiral bevel drive on the forward axle only. The standard gear ratio 7.4.

Both these models are rated at 3 tons, or 20,000 lb. maximum gross weight. They are available in two wheelbases, 168 in. standard and 186 in. optional (at extra cost). Service brakes are six-wheel hydraulics, with vacuum boosters and molded lining. They expand in 16-in. gun-iron drums. The external type parking brake is on the transmission. Eight-ply, 32 x 6-in. tires are standard.

Packard Reports Loss for Quarter

DETROIT, May 2—Packard Motor Car Co. has reported net loss of $1,563,983 after all charges, for quarter ended March 31, against a net income in the same period last year of $113,004.

French Industrialists Due

A delegation of French industrialists, members of technical and commercial associations belonging to the Confederation Generale de la Production Francaise, will arrive in New York on May 10 for a tour of inspection of American manufacturing plants.

The party will split up into different groups according to their particular interests (electricity, building and architecture, automobiles, textiles, food products), and each group will be escorted by a French engineer residing in the United States. For the automobile group the following visits have been arranged for: International Harvester Co., General Motors Corp., A. O. Smith Co., Fisher Body Co., Edward G. Budd Mfg. Co. and B. F. Goodrich Mfg. Co.

Plymouth Gains In Wayne Sales

Chevrolet Holds Own as Leader for March

DETROIT, May 4 — April Wayne County registrations, while 4 per cent over March, showed a decided decline in dollar volume and a decline from last year of 52 per cent.

The best showing was made by Plymouth with its new car registrations gaining 351 over last April and 271 over March. Chevrolet with a gain of 318 over March held first place. Plymouth was second and Ford third with a total of 255. The only other companies to show increased registrations over March were Nash, Oldsmobile and Pontiac. Only five companies showed better sales in April than last year. These were Plymouth, DeSoto, Nash with its new models, Graham and Packard, due to its light eight. Commercial car registrations showed a decline of 37 per cent during March. Largest declines were recorded by Chevrolet and Ford, while Federal and G.M.C. showed gains.

Canadian Studebaker Shipments Increase

WALKERVILLE, ONT., May 4—Passenger car and truck shipments to dealers by Studebaker of Canada, for four months ending April 30, were 24 per cent greater than for the same period last year. Figures include Studebaker cars and trucks, Rockne and Pierce-Arrow.

Houdaille-Hershey Loss

DETROIT, May 5—Houdaille-Hershey Corp. reports for the quarter ended March 31 net consolidated loss of $255,592, after interest, depreciation and after accrued dividends on Class A stock of its subsidiary, Muskegon Motor Specialties Co.

DeSoto Breaks Weekly Records

DETROIT, May 2—DeSoto retail deliveries during the week ended April 23, totaled 1787 cars, breaking all weekly sales records in the history of the DeSoto dealer organization. This figure includes Plymouth sales by DeSoto dealers in addition to DeSoto.

For the year to date sales of DeSoto and Plymouth cars by DeSoto dealers are running 60 per cent ahead of the corresponding period of last year.

Ex-Cell-O Profit is $43,786

DETROIT, May 3 — Ex-Cell-O Aircraft and Tool Corp. has reported for quarter ended March 31 a net profit of $43,786, after all charges but before Federal taxes, compared with net loss of $98,115 for the first quarter of 1931.

Current assets as of March 31, 1932, were $726,862, compared with current liabilities of $264,023.

Motor Vehicle and Parts Exports Take Second Place in 1931

U. S. exports of automobiles and parts in 1931 were valued at less than half than exports of unmanufactured cotton, according to an analysis published in chart form by the foreign commerce department of the Chamber of Commerce of the U. S. A. Automobile exports, however, retained second place in the ranking. When lumped with exports of products necessary to the operation of motor vehicles, the position of these broadly-construed automotive exports is considerably improved and might be considered as of first rank, with a ratio to total U. S. exports, in the order of 18.5 per cent. A summary of 1931 automotive exports by commodities, follows:

Rank	Commodity	Value	Per Cent of Total Exports
2	Automobiles, parts	$146,693,000	6.2
4	Gasoline, naptha	109,301,000	4.6
7	Lubricating oil	62,986,000	2.6
8	Agricultural machinery	57,403,000	2.4
20	Gas and fuel oil	23,966,000	1.0
22	Crude petroleum	20,828,000	0.9
24	Automobile tires	18,469,000	0.8

Exports of unmanufactured cotton, first in the ranking, had a value of $325,593,000 in 1931, 13.7 per cent of total exports. The tabulation above does not take into account exports of a number of commodities entering into the manufacture of motor vehicles, a percentage of which would naturally be exported for that purpose.

Air Passengers Show 31 Per Cent Gain

86,763 Were Carried in First Quarter of '32

NEW YORK, May 4—A report by the Aeronautical Chamber of Commerce of America, Inc., will show that 86,763 passengers were carried on air transport lines during the first quarter of the year, an increase of 31 per cent, as compared with the same period of 1931 when 66,399 passengers were flown.

A careful estimate places the number of air passengers that may be expected to fly the air lines during the current year at 575,000, or an average of nearly 48,000 passengers a month. A total of 22,555,392 passenger miles were reported flown during the first quarter of this year, or 43 per cent more than the 15,692,357 reported in 1931.

Similarly, better and more frequent schedules offered to the public resulted in a 59 per cent increase in scheduled miles from 8,375,314 in 1931 to 13,317,116 in 1932. Miles flown, equaling between 85 and 90 per cent of the miles scheduled totaled 11,359,978 in 1932, as compared with 7,427,641 in 1931.

Preliminary figures for air mail in March of this year bring the total volume for the first quarter to 2,073,338 lb. This is four per cent less than the 2,158,918 lb. carried during the first three months of 1931.

Air Express during the first quarter of 1932 totaled 283,626 lb., an increase of 36 per cent, as compared with the 209,004 lb. reported for the same period of 1931.

Gasoline and oil consumption during the first quarter of 1932 increased in nearly the same proportion as miles flown, 4,535,422 gal. of gasoline being used and 133,013 gal. of oil.

Fruehauf Trailers

Several improvements have been made recently in various products of the Fruehauf Trailer Company's line and new items have been added. The semi-trailers are now provided with a new floating coupler (or fifth wheel) in which blocks of live rubber replace the usual draft springs. The rubber is molded around a steel shackle fastened to the pivot pin, and provided with a special housing. It insulates the semi-trailer from the tractor truck in such a way that shocks in all directions are cushioned.

The "manual" coupler has been improved by providing it with a simplified coupling and locking mechanism. The coupling action is automatic, while uncoupling is effected by pulling a handle conveniently located on the front of the coupler. When the trailer is uncoupled it is ready for another automatic coupling.

A line of four-wheel trailers with narrow, pressed-steel frames has been introduced by the company. There is a small drop in the frame immediately back of the front wheels, which allows front-wheel clearance and—by lowering the rear part of the frame—eliminates the need for a built-up subframe for the rear wheels. At the forward end the frame rails are inswept to permit of a greater steering lock.

A new model of semi-trailer recently placed on the market is of intermediate capacity between the company's earlier light and heavy semi-trailers, and is made in two models, manual and automatic, and in various lengths. The frames are of pressed steel, with a small drop behind the tractor-truck driving wheels. Back of the drop the side rails are 10 in. deep. Two sets of outriggers replace forward body sills, and auxiliary springs cushion the load.

Radio Advertising of Motors Gains

But National and Farm Media Show April Recessions

Advertising by the automotive industry in national magazines and national farm magazines showed recessions for April, but the March total for radio broadcasting over national networks was almost exactly double that registered for the same month a year ago. The figure for April magazines was $1,683,913, a decline of 6.5 per cent from last year. National magazines accounted for $1,554,103 with a drop of four per cent and farm magazines accounted for $129,810, a drop of 28.4 per cent, according to figures compiled from National Advertising Records by the business survey department of Dorrance, Sullivan & Co., New York. Of the total in national magazines, $1,091,735 went for passenger cars and trucks, $205,603 for tires and tubes, and $256,765 for accessories.

The cumulative total in national magazines and farm magazines for the first four months of the year was $5,777,553, representing a decline for national magazines of 6.9 per cent and for farm magazines of 36.7 per cent, with the total recession for both groups amounting to 9.7 per cent.

The expenditure for radio advertising over national networks was $234,127 in March, 100 per cent ahead of the figure of $117,063 established for March a year ago. The increased appropriation for this medium served to bring the March total for magazines and radio to $1,765,035, a gain of 3.7 per cent over the 1931 total of $1,701,723. Total radio expenditures for the first quarter were $697,001, a gain of 99.5 per cent, but the total advertising expenditure for national media in the first quarter was $4,790,641, behind last year by 3.3 per cent.

Spanish Aero Publication Appears

There has just appeared Vol. 1, No. 1 of the "Revista de Aeronautica" published under the direction of the chief of aviation of the War Ministry of the Spanish Republic. The first number, which is dated April, 1932, devotes considerable space to American planes and engines. The publication, which is very attractive in format, will be devoted to the official aviation organizations in the Spanish Republic, but will be available for general subscription.

Working on P. O. Order

DETROIT, May 2—Work on 1500 mail-truck bodies for the Post Office Department has been started by the General Motors Truck Co., Pontiac. Complete delivery of the entire order is anticipated within four months.

Willys Sails; Will End Warsaw Task

Resigned Ambassador Will Return to Toledo in June to Head Willys-Overland

NEW YORK, May 4—John N. Willys, who resigned last week as ambassador to Poland, sailed tonight aboard the Bremen for Europe to arrange his affairs preparatory to leaving his post in June.

"I shall make immediate arrangements to move back to the United States to take care of my various interests here, especially to be more active and helpful in my duties as chairman of the Willys-Overland Co.," he said.

In a statement to the stockholders, President L. A. Miller of Willys-Overland said: "We are particularly fortunate in Mr. Willys' decision to resume active participation in the affairs of Willys-Overland.

"For more than a quarter of a century he has been recognized as one of the most forceful and resourceful leaders in the automobile industry, and his renewed active interest in the affairs of the company should have an immediate beneficial effect which will be welcomed by all of his associates.

"In resigning his ambassadorship Mr. Willys declared that he had accomplished what he set out to do in Poland and feels that his most important duty at this time is to give the company he founded the benefit of his long experience. Mr. Willys has always enjoyed the utmost confidence of his company's dealers and distributors and his renewed activities with the executive family undoubtedly will be received by them with gratification."

Directors elected at the annual meeting were, Mr. Willys, chairman; C. O. Miniger, George M. Jones, Marshall Field, Charles F. Glore, Rathbun Fuller, Gordon M. Mather, Thomas H. Tracy, L. A. Miller, J. H. Gerkens and T. A. Russell.

Officers were reelected as follows: L. A. Miller, president; J. H. Gerkens, vice-president and treasurer; H. B. Harper, vice-president in charge of sales; A. B. Qualy, secretary; W. E. Miner, comptroller.

The executive committee was elected by the directors as follows: C. O. Miniger, chairman; George M. Jones, Charles F. Glore, Rathbun Fuller, Gordon M. Mather, L. A. Miller.

Corben Plant Moved

MADISON, WIS., May 2—The Corben Sport Plane Co., Peru, Ind., maker of light aircraft and parts, has moved its plant and offices to Madison, where it will resume production May 8 in a factory near the Madison airport. L. F. Schoelkopf of Madison recently acquired the major interest in the concern. He is also owner of the Madison airport. O. G. Corben, chief engineer and designer, comes to Madison and will be vice-president and general manager of the aircraft company.

White Elects Dahl and Kelly

At the annual meeting of stockholders of White Motor Co., Cleveland, members of the board of directors were reelected and T. R. Dahl and George H. Kelly were elected as additional members.

The board is now composed of R. W. Woodruff, chairman; A. G. Bean, Charles L. Bradley, Warren S. Hayden, Otto Miller, Homer H. Johnson, J. R. Nutt, E. W. Stetson, Walter C. Teagle, E. R. Tinker, W. King White, T. R. Dahl and George H. Kelly.

Following the stockholders' meeting directors reelected A. G. Bean, as president, and all other present officers of the company.

T. R. Dahl has been with the company for more than 20 years and is vice-president and secretary. He is regarded as one of the foremost authorities in the country on motor transportation, being a spokesman for the industry in the National Automobile Chamber of Commerce.

George H. Kelly has been treasurer of the company for the past ten years, and two years ago was elevated to a vice-presidency. His affiliation with the company dates back to 1915 in connection with selling national accounts. He has a wide acquaintance in business and financial circles throughout the country.

Oshkosh Gets Contract

OSHKOSH, WIS., May 2—Oshkosh Motor Truck, Inc., reports that it has been awarded a Government contact to supply 10 of its largest size of four-wheel-drive units. The order will enable the company to keep its full crew at work for the next two months.

Charles Pflittner

MILWAUKEE, May 2—Charles Pflittner, formerly superintendent of the Barton Axle Co., Barton, Wis., and known as a designer of automotive parts and units, died April 27 as the result of an accident. He was 48 years old.

Smith Plant Active

MILWAUKEE, May 2—Activities of the automobile frame division of the A. O. Smith Corp. have improved materially during the past two to three weeks, although production is still below a year ago.

Strip Steel Orders Show Improvement

Ford, General Motors Bookings Are More Consistent, Mills Report

NEW YORK, May 5—The measure of support accorded to the steel market by automotive consumers during the first week of May was virtually unchanged from that of the final April week. In fact, slight gains in sheet and strip steel bookings made possible somewhat improved operations in the finishing mills of most districts.

Steel rollers, catering to automotive parts makers, see in the manner in which Ford business is being placed the advent of routine covering of requirements by that consumer.

General Motors orders are also coming through in a consistent manner, slight dips in the takings for one plant being made up by corresponding increases in the specifications for others.

Very little in the way of specifying against old low-priced steel bar contracts is reported to have come through when the time limit expired last week, and the market is supposedly on a uniform 1.60 cents, Pittsburgh, and 1.70 cents, Chicago, basis with intimations that further advances will be attempted by sellers in the near future.

This, however, for the time being is more of an indication that the market is entering upon a period when prices will be subjected to real tests than as concrete evidence of a rising tendency. With the demand on the present light volume basis, the market being very much of a small lot affair all around, sellers anticipate little difficulty in maintaining prices.

Chicago jobbers have advanced bolt and nut prices 5 per cent. Like in all commodity markets, eyes of those in the steel market are turned toward Washington for signs of the ultimate fate of efforts in Congress to lift price levels through legislation.

Pig Iron—Lake furnaces are reported to be shipping more iron to automotive foundries. Some ferro-alloy business is reported to have been placed by Ford. The market for No. 2 foundry and malleable is slightly steadier on an unchanged price basis.

Aluminum—Within the moderate limits that have characterized automotive takings of foundry metal last month May inquiry is rather encouraging. Prices are unchanged.

Copper—Marking time with 5¾c, delivered Connecticut Valley, the producers' price, being fractionally shaded in the "outside" market.

Tin—Reports from London that Malaya producers plan a two months' shutdown as a further means of relieving the situation caused a full cent advance in the market. Straits for prompt delivery being quoted at 20c at the week's beginning.

Lead—Steady and moderately active.

Zinc—Weak and dull.

N.A.C.C. Resigns Its Membership in Bureau Permanent at Paris

NEW YORK, May 4—For the second time in its existence, the National Automobile Chamber of Commerce has withdrawn from the Bureau Permanent des Constructeurs d'Automobiles, the international association of automobile manufacturers in Paris. John V. Lawrence, European representative of the chamber, has been instructed to deliver the official notification to the Bureau Permanent, according to Alfred Reeves, vice-president of the N.A.C.C.

That the action of the N.A.C.C. will be followed by a similar move on the part of the (British) Society of Motor Manufacturers and Traders, British publications have indicated recently. The move was discussed at the last meeting of the Bureau Permanent, but no decision was made. Six months notice is necessary before any resignation can take effect.

The chamber's action was taken with regret, explained Mr. Reeves, because of the apparent impossibility of stimulating the development of highway usage throughout the world on the scale contemplated when the American manufacturers were invited to participate in the association's program eight years ago.

The purpose of the Bureau Permanent when it was organized was to coordinate the efforts of seven automobile manufacturing countries in promoting highway transportation in the one hundred or more other countries throughout the world where motor vehicles are not manufactured.

After being a member of the Bureau Permanent for several years, the N.A.C.C. resigned its affiliation shortly after the war. Eight years ago it was invited to participate in a program of institutional highway development, and through the efforts of Roy D. Chapin, chairman of the Hudson Motor Car Co., and Alvan Macauley, president of the Packard Motor Car Co. and of the N.A.C.C., regained its affiliation. In recent years the highway promotion program of the N.A.C.C. has been proceeding on a broad scale along independent lines.

Dissatisfaction over conditions under which American automobile manufacturers have been admitted to the Paris Salon has resulted in recent years in General Motors holding its own show in Paris. Formal complaints lodged with the Bureau Permanent which exercises jurisdiction over such matters have apparently failed to produce a satisfactory solution for the grievances of American manufacturers.

The Bureau Permanent, at its last meeting, approved an all-British automobile exhibition on Danish territory, although the rules of the bureau provide that a showing by the manufacturers of one nation on the territory of another, must be international in scope.

M.E.M.A. Shifts Credit Set-Up

Manufacturers' Credit Department Will Be Moved to Detroit

Changes in the credit department of the Motor and Equipment Manufacturers Association, announced by A. H. Eichholz, general manager, will be effective as of May 1. All matters pertaining to manufacturers' credits will be centered in the association's Detroit office; while all matters having to do with wholesalers' credits and with export distributors' accounts will be concentrated in the New York office.

Under this arrangement A. H. Fagan has been named to the position of manager of wholesalers' credits; and T. M. Simpson, recently appointed manager of the Detroit office, becomes manager of manufacturers' credits. The change also results in the transfer of John E. Merz to Detroit where he will continue his work in connection with manufacturers' credits. The Detroit offices will remain at the same address, First National Bank Building, although larger quarters have been taken in the building.

The reorganization is the culmination of considerable study by the credit department committee, of which M. A. Moynihan, Gemmer Mfg. Co., is chairman. Members of the committee and directors of the association are confident that the new arrangement will result in even better service to all members inasmuch as it makes possible a degree of specialization that is greater than any ever attempted by the association.

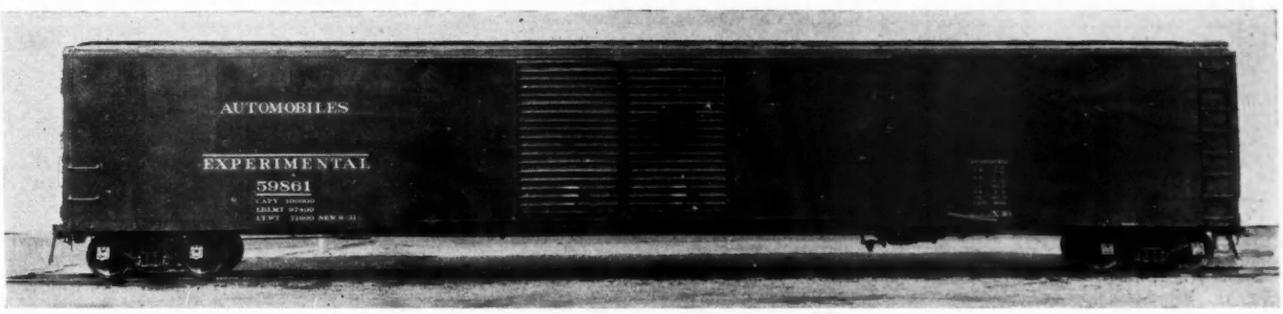
Citroen Representative at Madison-Kipp

Says Aim Is to Reduce Price of French Cars

MADISON, WIS., May 2—Paul Magnier, representative of Citroen Automobile Co. of France, has been spending several weeks here at the plant of the Madison-Kipp Corp. familiarizing himself with die-casting processes. Citroen purchased a number of Madison-Kipp die-casters last October and Mr. Magnier's visit is occasioned by a desire to improve production results. The machines are capable of turning out 160 units of body trimmings to one unit by the French hand method. From here he expects to go to Detroit to study Ford production methods. Mr. Magnier said that French workmen would like to buy automobiles, but the price of the Citroen is about $850 in American money and to buy one at the present price would require all of the wages of a factory worker for two and a half years. By introducing mass production methods, he said, the company hopes to be able to market its car profitably at around $500.

Build Powerful Truck

CLINTONVILLE, WIS., May 2—One of the most powerful trucks ever built by the Four Wheel Drive Auto Co. here was shipped during the past week to the Onondaga County highway department at Syracuse, N. Y. The truck is powered by a 127-hp. engine and has a transmission with eight forward and two reverse speeds.



The Pennsylvania Railroad is experimenting with the 76-ft. car shown above, which is designed to facilitate the shipping of automobiles. The car, which has end doors, was recently used by the American-La France & Foamite Corp. to ship a complete hook-and-ladder assembly

Business in Brief

Written by the Guaranty Trust Co., New York, exclusively for Automotive Industries

NEW YORK, May 4—The recent improvement in retail trade was maintained last week. Although the increase has not been particularly substantial, merchants are encouraged. It is the expectation in some quarters that the improvement in retail trade will continue and react favorably on wholesale and jobbing lines. Nevertheless, trade in general is far from satisfactory. The number of unemployed is still very large, and collections are slow.

CHAIN STORE SALES

Sales of 36 store chains during the first quarter of this year totaled $575,642,275, as against $638,042,853 during the corresponding period last year. Sales of 2 mail order houses amounted to $95,700,568, as against $119,497,603 a year ago.

ELECTRICITY PRODUCTION

Production of electricity by the electric light and power industry in the United States during the week ended April 23 was 12.3 per cent below that in the corresponding period last year.

CAR LOADINGS

Railway freight loadings during the week ended April 16 totaled 566,729 cars, which marks an increase of 21,923 cars above those during the preceding week, but a decrease of 192,765 cars below those a year ago and a decrease of 325,977 cars below those two years ago.

CRUDE OIL OUTPUT

Average daily crude oil production for the week ended April 23 amounted to 2,267,900 barrels, as against 2,181,650 barrels for the preceding week and 2,422,600 barrels a year ago.

FISHER'S INDEX

Professor Fisher's index of wholesale commodity prices for the week ended April 30 stood at 61.8, as against 61.8 the week before and 62.4 two weeks before.

BANK DEBITS

Bank debits to individual accounts outside of New York City during the week ended April 27 were 33 per cent below those a year ago.

STOCK MARKET

There was some improvement in the stock market during the earlier part of last week; but the decline in the latter part more than wiped out these gains, and moderate net losses for the week were quite general. The volume of trading was on a reduced scale. Despite the stimulation given to Government bonds by the purchases of the Federal Reserve banks, the market for corporation bonds continued to lose ground.

RESERVE STATEMENT

The consolidated statement of the Federal Reserve banks for the week ended April 27 showed a decrease of $33,000,000 in holdings of discounted bills. Holdings of bills bought in the open market remained unchanged, while holdings of Government securities increased $113,000,000. The reserve ratio on April 29 was 67.9 per cent., as against 69.2 per cent a week earlier and 69.4 per cent two weeks earlier.

Studebaker Names Fletcher

C. S. Fletcher has been placed in charge of Studebaker, Rockne and Pierce-Arrow business in South Africa for the Studebaker-Pierce-Arrow Export Corp., according to an announcement by Arvid L. Frank, vice-president and general manager. Prior to his appointment Mr. Fletcher served the corporation as special representative in the Orient. Later he was made supervisor of the Australasian territory, a position he held for the last year. He left his Sydney headquarters in March for Capetown, South Africa, and assumed his new duties early in April.

Murray G. Sawyer has been appointed special representative for Studebaker-Pierce-Arrow Export in west and central Africa. Mr. Sawyer sailed from New York for Europe early in April. He expects to arrive in his territory during the latter part of May.

B. O. P. Names Abbey

William S. Abbey, formerly assistant sales manager of the Flint sales zones of the Buick Motor Co., has been named sales promotion manager of the Detroit zone for the Buick-Olds-Pontiac Sales Company.

Aids "Buy New Car" Appeal

NEW YORK, May 2—The Ethyl Gasoline Corp. is sponsoring a "Buy a New Car Campaign" through paid advertising space in 20 well-known magazines.

Borzacchini Wins Italian Road Race

BRESCIA, ITALY, April 10 *(by mail)*—Driving a straight eight supercharged Alfa Romeo, Borzacchini won the Italian Thousand Miles road race today at an average of 68.102 m.p.h. The seven following cars were also Alfa Romeos. This race was held over ordinary roads, only partially closed to traffic and included a score of big towns, including Florence, Bologna and Rome. The Appenine mountains had to be crossed twice. There were 88 starters and 44 at the finish.

An exceedingly fast pace was set, the first 129 miles from Brescia to Bologna, which included five towns and the crossing of a long pontoon bridge, being covered by Nuvolari on an Alfa Romeo at an average of 100.53 miles per hour. Varzi on Bugatti and Caracciola on Alfa Romeo each averaged 100 miles per hour. The high speed was responsible for the elimination, by reason of road accidents, of many of the best drivers, including Campari, Varzi, Nuvolari, and Caracciola. Nobody was injured and there were no accidents to spectators.

DeVaux Names Miller

H. P. Miller has been made district manager of Continental-DeVaux Co., operating out of the DeVaux general sales offices in Grand Rapids.

+ + CALENDAR OF COMING EVENTS + +

FOREIGN SHOWS

Peznan, Poland, International Fair	May 1- 8
Dublin, Commercial	May 4- 7
Budapest, International Fair	May 7-16
Buenos Aires, Automobile Show	May 20-29
Belfast, Commercial	May 25-28
Bordeaux, Fair	June
Cork, Commercial	June
Inverness, Commercial	June 21-24
Southampton, Commercial	July 5- 9
Llandrindod, Wales, Commercial	July 20-22
London, Olympia Show	Oct. 13-22
Glasgow, Scottish Motor Show	Nov. 11-19

CONVENTIONS

American Gear Mrs. Assn., Sixteenth Annual Meeting, Cleveland	May 12-13
U. S. Chamber of Commerce, San Francisco, Cal.	May 16-20
American Iron & Steel Institute, New York (Semi-Annual)	May 19
National Battery Mfrs. Assn., Chicago, Ill.	May 19-20
Automotive Engine Rebuilders Assoc., Indianapolis	May 30-June 2
Natl. Automobile Chamber of Commerce, New York (Annual Meeting)	June 2
American Soc. Mechanical Eng. (Natl. Aeronautic Meeting) Buffalo	June 6- 8
American Soc. Mec. Eng. (Natl. Oil & Gas Meeting) State College, Pa.	June 8-11
Pacific Coast Aero. Meeting (A. S. M. E.), Berkeley, Calif.	June 9-10
Soc. of Automotive Engineers, White Sulphur Springs (Summer Meeting)	June 12-17
American Society for Testing Materials, Atlantic City (Annual Meeting)	June 20-24
Amer. Soc. Mechanical Engineers, Bigwin, Canada (Semi-Annual Meeting)	June 27-30
Natl. Association of Taxicab Owners, Chicago	July 7- 8
Natl. Team & Motor Truck Owners Assoc., Chicago (Annual)	July 17-19
National Team & Motor Truck Owners Assn., Detroit	July 17-19
S.A.E. Aircraft Meeting, Cleveland	Aug. 30-Sept. 1
American Society Mechanical Engineers, Cleveland, O. (Machine shop practice meeting)	Sept. 12-17
American Trade Association Executives, Atlantic City (Annual)	Sept. 15-17
Natl. Assoc. of Motor Bus Operators, Chicago	Sept. 22-23
Amer. Society for Steel Treating, Buffalo	Oct. 3
National Safety Council, Washington, D. C.	Oct. 3- 7
American Society Mechanical Engineers, Buffalo, N. Y. (Natl. Iron and Steel Meeting)	Oct. 3- 8
S. A. E., Annual Transportation Meeting, Toronto	Oct. 4- 6
American Gas Association, Atlantic City (Annual)	Oct. 10-14
American Society Mechanical Engineers, New York City (Annual Meeting)	Dec. 5- 9
Natl. Exposition of Power & Mechanical Engineering, New York	Dec. 5-10

RACES

Indianapolis	May 30
Detroit	June 5
Altoona	June 12
Roby, Ind	June 19
Altoona	Sept. 5

The FRACTIONAL SAVINGS that Appeared Insignificant

. . . . . It Was Common in 1928-29

Now . . . . . LOOM LARGE

In Today's Close Figuring

Times have changed—so have gear-set designs. Irrespective of your reasons for postponing the adoption of modernization plans, *you need* the High Speed Gear Shaper NOW. Quiet gear operation is essential, and the lack of it handicaps sales in today's highly competitive market. You need high accuracy coupled with good engineering and low production costs.

THE GEAR SHAPER METHOD, including ORIGINAL FELLOWS CUTTERS, and more particularly the Improved Fellows Helical Cutter, produces uniformly accurate gears at costs that represent worthwhile savings.

As a concrete example: One large motor car manufacturer was assessing one dollar to each car built to take care of transmission teardowns. High Speed Gear Shapers and original Fellows Cutters eliminated the necessity for this assessment.

Figure it any way you will. The saving resulting from the use of modern High Speed Gear Shapers is important. You are losing potential profits by postponing. Why not ask to have one of our representatives call and give you complete information on recent developments made to cut gear production costs. Write: The Fellows Gear Shaper Company, 78 River Street, Springfield, Vermont (616 Fisher Building, Detroit, Michigan).

FELLOWS
GEAR SHAPERS

NEW DEVELOPMENTS
Automotive Parts, Accessories and Production Tools

Heald No. 81 Internal Grinder

An internal grinding machine designed for handling small work at high rates has been placed on the market by the Heald Machine Co., Worcester, Mass. The Style 81 machine takes work up to about 1 in. diameter and 2 in. maximum length. Several of these machines have been employed in regular production to demonstrate its possibilities. In one large ball bearing plant this machine is said to have doubled production and yet shown better accuracy.

This machine is fully automatic with the exception of starting, loading, and unloading the work. It can be arranged to size the work Size-Matically, or Gage-Matically, or if desired a combination of the two. All machines can be operated as plain machines.

While the general functions of the No. 81 are similar to the No. 72 Heald, there is one distinct difference in that the workhead and work reciprocate with the main table instead of the wheelhead and wheel.

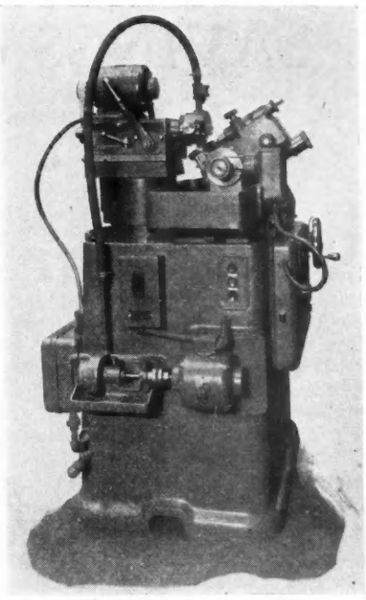
This arrangement has important advantages for a small machine. It permits the entire machine to be driven by one standard single end motor. It gives the most rigid support for the wheelhead, and permits the very high speeds so necessary on small holes, also the cross slide and control box are in a fixed relationship to one another, allowing the use of all mechanical controls for sizing, thus eliminating the necessity for any electrical connections.

Particular attention has been given to a complete guarding and enclosing of units, mechanisms and belts. Guards that must be removed for minor adjustments or service are held with springs and can be removed without tools. The work is unusually well guarded against splash and leakage of coolant, the table dogs covered and the cross slide feeding mechanism is completely enclosed and runs in oil. It has a built-in motor with built-in electrical controls, also a self-contained water tank located within the size limits of the base, thus requiring only minimum floor space.

Motor drive is by a 5 or 7½-hp. motor, 1800 r.p.m. Floor space, 42 x 55 in. Net weight, 3200 lb.

Helical Cutter Sharpening Machine

The Fellows Gear Shaper Co., Springfield, Vt., announces a fully automatic helical cutter sharpening machine adapted to the sharpening of so-called "normal sharpened" helical gear shaper cutters and provided with complete electrical control. It is supplied with three motors—one reciprocates the table through a reduction gear and crank mechanism; another drives the pump for supplying coolant to wheel and work; and the third drives the grinding wheel through an endless canvas belt. Cutters having helix angles up to and including 50 degrees can be sharpened on this machine.



The indexing, as well as the reciprocation of the cutter, is taken care of automatically, and an electrical con-

(Turn to page 710, please)

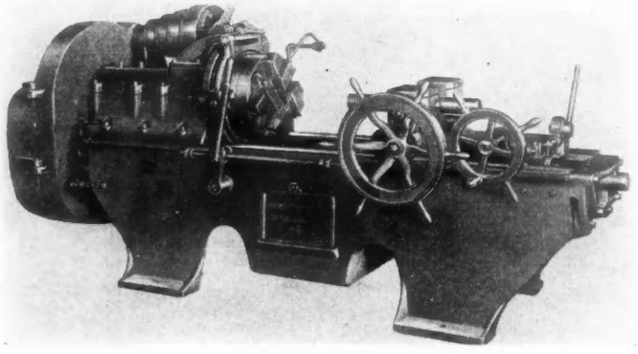
Landis Rotary Die Head

A new die head having a capacity up to and including 4 in. diameters and equipped with a roughing and finishing attachment has been developed by the Landis Machine Co., Inc., Waynesboro, Pa., for use on the Landis 4 in. leadscrew threading machine. This die head is recommended for cutting coarse-pitch threads on work which requires accuracy and smooth finish.

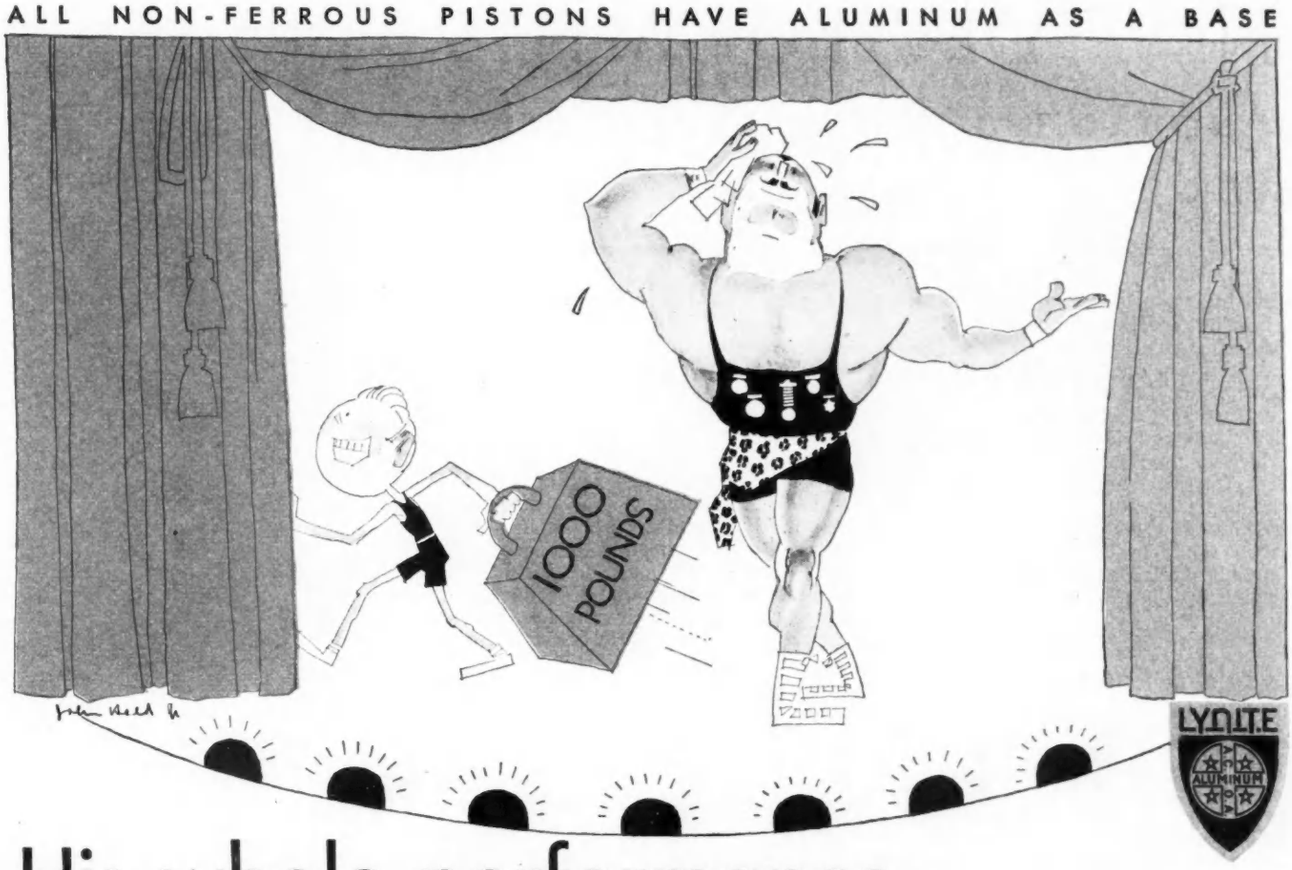
The roughing and finishing cuts are controlled by a latch mounted on the yoke bracket. The release of the latch, after the roughing cut is made, permits the die head to close for a light finishing cut. The amount of metal removed during this cut is approximately 0.045 in.

No cutting strains are transmitted either to the die head yoke or the roughing and finishing attachment. The die head is locked within itself when set for either the roughing or finishing cut, thus making it possible to produce threads free from taper and uniformly accurate.

A pitch indicator is employed to assist the operator in timing the engagement of the leadscrew nut for the finishing cut.



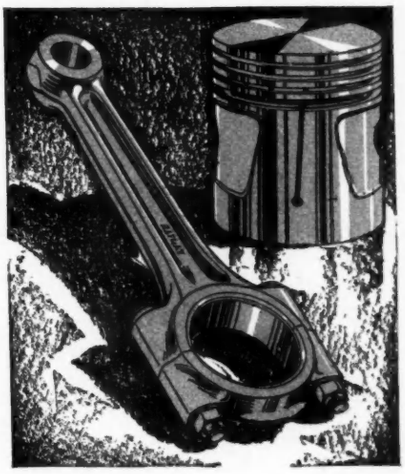
ALL NON-FERROUS PISTONS HAVE ALUMINUM AS A BASE



His whole performance...

depends upon a light, reciprocating part

Today, the "strong men" among the engineers of the automotive industry are centering their attention upon lightening the weight of reciprocating parts for 1933 model engines—engines of yet greater speed and higher compression ratios. Obviously, higher speed means higher bearing pressure. And reduction of weight of reciprocating parts reduces bearing pressure and thus lengthens bearing life. That's why Lynite Pistons and Connecting Rods are a vital necessity. For the strong alloys af Alcoa Aluminum, from which Lynite Pistons and Connecting Rods are made, weigh only 1/3 as much as other metals commonly used.



Consider what happens when you put weight into motion. Static weight changes to dynamic weight, striking blow after blow—3000 blows a minute—at the very heart of the motor. So a few static pounds saved are multiplied in motion into dynamic *tons* saved. And there's an immense lessening of wear on bearings—a real factor in lengthening bearing and engine life. Lynite Pistons and Connecting Rods have other advantages, too. Because they're made of the strong alloys of Alcoa Aluminum, they carry away the terrific heat of high compression many times faster than do reciprocating parts made of other metals.

No wonder then that designers of famous cars who plan new models that shall run cooler, have quicker acceleration, greater speed, more pulling power, give better gas mileage, develop less carbon and have longer piston life, use Lynite Pistons and Connecting Rods. It pays to specify both as standard equipment. ALUMINUM COMPANY of AMERICA; 2410 Oliver Building, PITTSBURGH, PENNSYLVANIA.

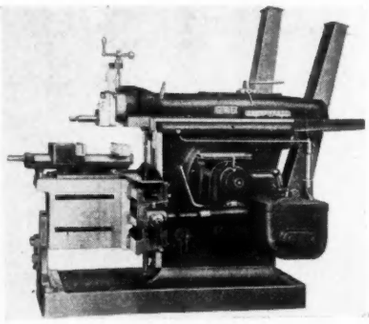
LYNITE PISTONS
AND CONNECTING RODS
MADE OF ALCOA ALUMINUM

NEW DEVELOPMENTS
Automotive Parts, Accessories and Production Tools

trol is arranged so that the machine stops automatically at the completion of each revolution of the cutter. Three push buttons are provided at the front of the machine, one for starting the reciprocation of the table, the second for "jogging" the table electrically, which is necessary when setting up, and the third for manually stopping the machine. A guard is provided for keeping the stop button depressed, when the operator is "jogging," or partially reciprocating the table, when setting up the machine.

Gould & Eberhardt Industrial Shapers

Gould & Eberhardt, Newark (Irvington), N. J., has developed a line of crank shapers in a selection of 22 different models, to serve all industries. Machines are available in sizes from 16-in. to 32-in. stroke inclusive. Some of the outstanding features of these industrial shapers are:



Rapid power traverse to the work table is built in and operates in a direction opposite to the feed set. The table is traversed in either direction at 100 in. per min., by a self-releasing control, which automatically reinstates the feed. A safety device prevents damage.

Automatic cross-feed to the table is operated by a single cam, synchronized with the return stroke of the ram. Sixteen changes of feed are available from 0.012 to 0.200 in. The safety device, common to the rapid power traverse mechanism, prevents damage, should the table be fed to the extreme ends of the rail.

The double-crank gear transmission, an exclusive feature used for over 30 years, has been retained. The two-crank gear terminus provides a wide range of strokes, without excessive gear speed.

A non-slip table support is provided for guiding and supporting the front end of the table. The adjustable stress block positively locks the table support and prevents slippage of the clamping bolt.

These machines are regularly furnished single-pulley belt drive, mounted on Timken bearings. The starting clutch and brake are operated by a single control. Machines may be arranged for direct-connected motor drive, by a pair of gears, multiple vee belts, or chain.

Toledo Torque Dynamometer

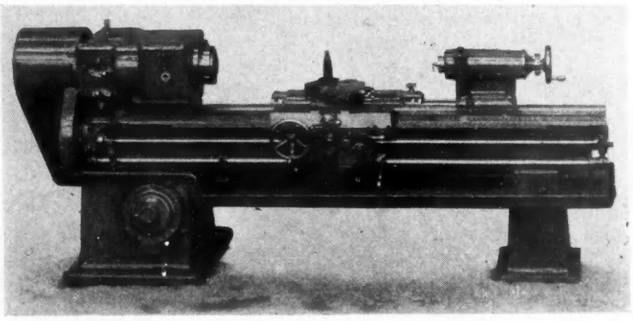
A torque dynamometer for measuring the stalling torque of electric starter motors has been developed by Toledo Precision Devices, Inc., Toledo, Ohio. It is a high-production testing machine, the cycle of operations taking only about 15 sec., according to the manufacturer.

The dynamometer is designed for mounting on a bench. A cradle for the motor to be tested is placed adjacent to it. The testing is as follows: The shaft of the motor is placed in alignment with a horizontal arm extending out from the dyna-

mometer. After the motor is clamped into position by an eccentric, the sliding coupling on the horizontal arm is pushed over the shaft of the motor. The clamping device engages with a keyseat in the end of the motor shaft. Current is then applied to start the motor revolving. It is, however, prevented from revolving by the arm of the dynamometer. The downward pressure on the arm registers on the dial, and the operator reads the stalling torque.

Ultra-Hi-Speed Production Lathe

The R. K. LeBlond Machine Tool Co., Cincinnati, has just completed an extra heavy-duty, rapid-production lathe with a Timken helical-geared head. This is an entirely new machine, developed for use with cemented carbide tools.



This machine is driven by a 25-hp., variable-speed motor, and has spindle speeds ranging from 150 r.p.m. to 2400 r.p.m. Speeds from 150 r.p.m. to 600 r.p.m. are obtained by driving through a set of back gears, while speeds from 600 r.p.m. to 2400 r.p.m. are obtained by a direct drive to the spindle. A six-sheave, vee-belt drive is used.

All feed gears are in the headstock and are mounted on Timken bearings. Nine feed changes are available, ranging from 0.002 in. per revolution to 0.025 in. per revolution. The automatic length stop consists of a positive clutch which is disengaged by a boss on the apron engaging an adjustable trip dog on the controller rod.

The taper attachment is of an improved design. The guide bar is made exceptionally rigid by reinforcing it with the heavy rib, while accurate alignment of the guide-bar shoe is insured by locating the bar near the center of the cross-feed screw, and supporting it by the carriage shoe.